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ELECTRICAL WORLD

A consolidation of Electrical World, Electrical Engineer and American Electrician

L. W. W. MORROW, *Editor*

FRANK R. INNES
Western Editor
520 N. Michigan Ave.
Chicago
H. S. KNOWLTON
New England Editor
1427 Statler Bldg.
Boston
WALTER C. HESTON
Pacific Coast Editor
883 Mission St.
San Francisco
PAUL WOOTON
Washington
Correspondent
National Press Bldg.
Washington

JAMES H. RUDD
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JULY 26, 1930

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McGRAW-HILL PUBLISHING COMPANY, INC., Tenth Ave. at 36th St., New York, N. Y.

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CABLE ADDRESS: "MACHINIST, N. Y."

Published weekly. $5 per year. 25 cents per copy. Entered as second-class matter, January 20, 1907, at the Post Office at New York, N. Y., under the Act of March 3, 1879. Printed in U. S. A.

Member A.B.C.
Member A.B.P.

NUMBER OF COPIES PRINTED THIS ISSUE, 13,450

NEW YORK District Office, 285 Madison Avenue
WASHINGTON, National Press Building
CHICAGO, 520 N. Michigan Avenue
PHILADELPHIA, 1600 Arch Street
CLEVELAND, 501 Guardian Building
ST. LOUIS, 1556 Bell Telephone Building
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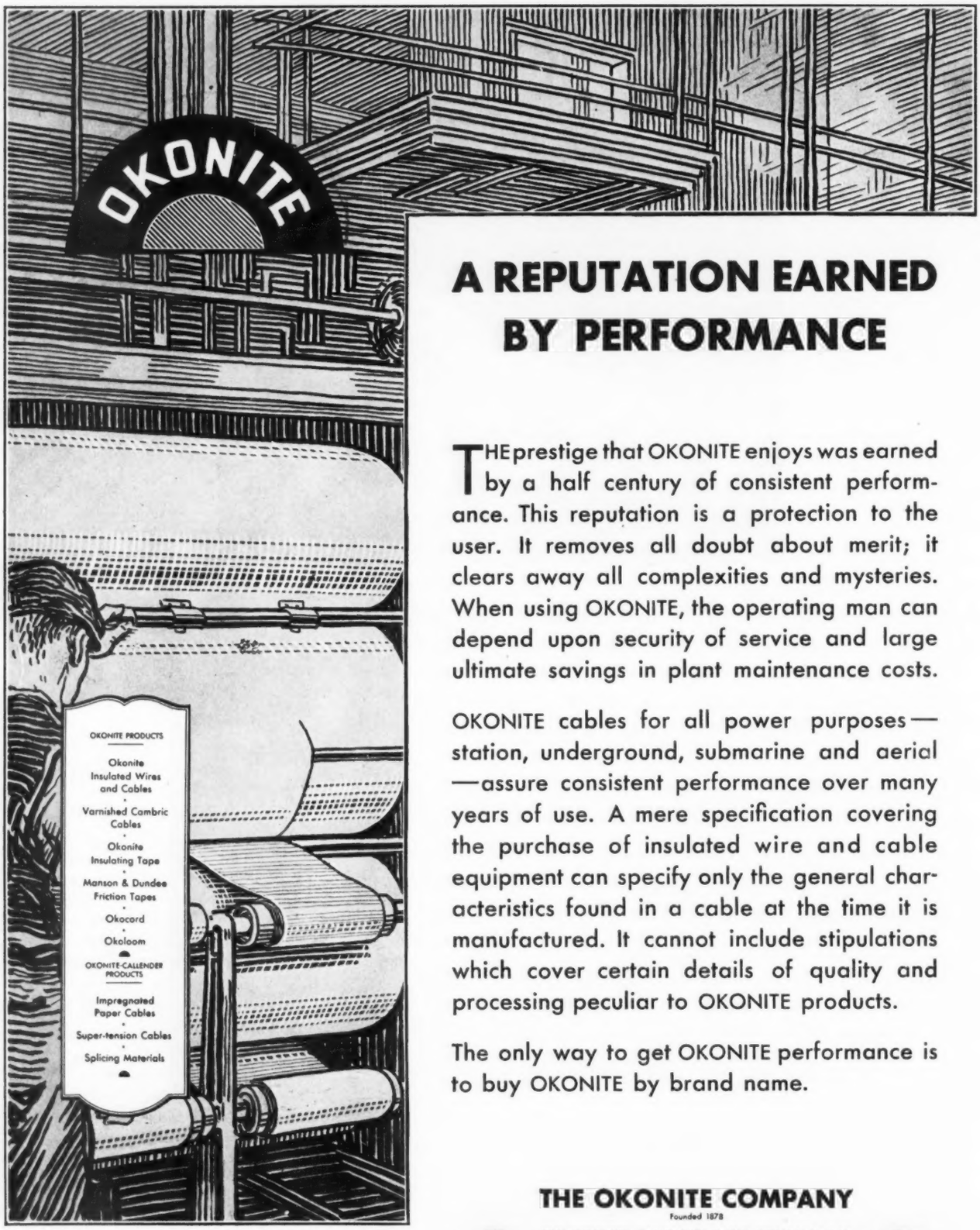

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ELECTRICAL WORLD

for the Week Ending

July 26, 1930

N.E.L.A. Section Chairmen Appointed

Railroad Electrification Gains Momentum

Electrical Progress in German Republic

New Federal Power Board Still Unborn

—NEW JERSEY occupies a strategical position where electrification of steam railroads is concerned. The Lackawanna's present and the Pennsylvania's and the Reading's future programs must all take her in. The D., L. & W. has made a good beginning.

—A BENEFICENT byproduct of hydro-electric development is the anti-malaria campaign it brings in marshy regions. A present outstanding example is found in the Georgia Power Company's operations at Furman Shoals.

—GERMANY is on the up-grade economically, industrially and electrically, says an American observer. Consumption of energy has risen 50 per cent in four years.

—ADEQUATE wiring is a vital element in preventing city buildings from becoming out-of-date and unremunerative. Minimum specifications are now codified.

—THREE engineers of high standing will guide Los Angeles Water and Power Commission in mapping program before bond issue for $19,000,000 is submitted. History's lessons are not always wasted.

—SENATE adjourns without action on President's first three nominations for the new Federal Power Commission. No doubt the Upper House will have a complete slate for its appraisal when it reassembles in December. After all, a good start is more important than a fast one.

—A NEW YORK CITY municipal court takes a hand in the battle over submetering by ruling that landlords selling energy must have a commission certificate of convenience and necessity. No one has attacked the problem from just that point of view.

—LOAD DISPATCHING over the extended transmission system of the New England Power Association has been worked out along symmetrical lines that contain many hints for other organizations.

NEWS OF THE WEEK

Three Railroads Push Electrification in New Jersey and Pennsylvania

SUPPLEMENTING the announcement printed on July 19 (page 98) concerning the progress being made on the Delaware, Lackawanna & Western's electrification of its suburban New Jersey lines, details sent by a company representative to the ELECTRICAL WORLD tell of the letting of contracts for the construction of 141 all-steel vestibuled motor cars and the conversion of a similar number of the latest models of suburban coaches formerly used into vestibuled trailers. This equipment will be operated in units of motor and trailer and coupled to form trains up to twelve cars in length, each car accommodating from 78 to 84 passengers.

Alternating current, varying in voltage from 13,000 to 66,000, will reach the railroad through five substations—those at Bergen Junction and Roseville (Newark) receiving energy from the Public Service Electric & Gas Company, that at Summit from the Jersey Central Power & Light Company, and those at Bernardsville and Denville from the New Jersey Power & Light Company. At each of these substations thirteen rectifiers and an equal number of transformers convert the electricity to 3,000 volts direct current. The larger rectifiers will operate at 3,000 volts and are believed to be the largest ever to operate at so high a figure.

Electrification on the railroad has now progressed to a point where trains can be run over part of the system. At 4 p.m. on Thursday, July 17, the first of the new multiple-unit trains was operated. Since that time four-car and eight-car trains have been run daily between Bergen Junction and Secaucus for the purpose of testing equipment and instructing trainmen. Runs have also been made along the main line from Bergen Junction to Harrison Tower. On July 23 representatives of the technical press visited the Bergen substation and inspected the new cars in operation.

Substation equipment is being installed according to schedule. Buildings are completed and electrical apparatus is approximately 50 per cent in place. New cars are arriving and trailers are being converted at the rate of one each per day and will continue on that schedule until the completion of the 141 units. As before reported, service to the public will begin about the middle of September on the Montclair Division.

This improvement is being made by the Lackawanna Railroad at the express desire of passengers, who declared their willingness to bear their share of the expenditure involved by paying higher prices for commutation tickets. Operation at 3,000 volts direct current was decided upon—for the first time in America as regards suburban service—because it was deemed the best to meet the requirements of both suburban and main-line operation and with a possible extension of the electrified zone over the mountains to Scranton and the anthracite coal fields, 134 miles away, in view as a future goal.

On the Pennsylvania

With the change made this week from steam to electric power on its Schuylkill division, which embraces 17 miles of trackage between Philadelphia and Norristown, the Pennsylvania Railroad will have in operation 354 miles of electrified line mileage and 683 miles of track mileage, representing approximately one-fifth of the total electrified line mileage and one-quarter of the electrified track mileage of all railroads in the United States. It will operate in the Philadelphia suburban zone a total of 131 miles of electrified line and 426 miles of electrified track.

The general electrification program covers much of Pennsylvania's important Eastern track mileage. It will in the comparatively near future involve a change from steam to electric power of both passenger and freight service

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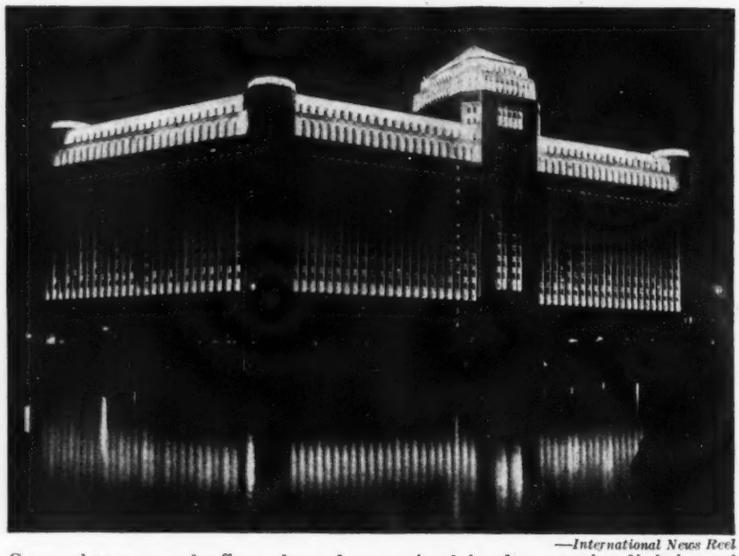
CHICAGO RIVER REFLECTS LIGHTING SCHEME



—*International News Reel*

Somewhat unusual effects have been gained in the exterior lighting of the Merchandise Mart Building, on the north bank of the Chicago River, which gives by reflection a touch of beauty to the murky waters of the stream.

from Hell Gate Bridge, N. Y., through Philadelphia and Baltimore to the Potomac gateway at Washington. Ultimately the program calls for the electrification of the main line west from Philadelphia as far as Atglen, Pa., and the low-grade freight lines between the Susquehanna River Valley and the railroad's eastern terminals.

Completion of this program, at a cost of more than $100,000,000, will give the road a total of 800 miles of electrified line and 2,760 miles of electrified track.

On the Reading

The Reading Company is pushing its electrification program in the Philadelphia suburban zone, and the work to date is considerably ahead of schedule. When the work was started, early in 1929, it was expected that the line between Philadelphia and Lansdale would be put into operation in April, 1931, and that the second electrified line, from Philadelphia to Langhorne, would be placed in operation in September, 1931. It is now believed that the two lines will be placed in operation simultaneously, and it is possible that both will be completed a month or so before the earlier date.

It was recently announced by the Reading that the Doylestown branch, a 10-mile stretch from Lansdale to Doylestown, will also be electrified to obviate the necessity of changing to steam trains at Lansdale. Early steps also include the line from Philadelphia to Chestnut Hill and the branch from Glenside to Hatboro. It is estimated that the electrification embraced in the present program will cost $20,300,000. Upon its completion it is predicted that the railroad will be electrified from Langhorne to Bound Brook, N. J., and ultimately to New York, and from Lansdale to Bethlehem and through the Schuylkill Valley as far as Reading. The approximate cost of the second step is put at $32,000,000.

▼

Public Hearings on All Mergers in Wisconsin

BY RECENT edict of the Wisconsin Railroad Commission, no more permits will be granted for mergers of public utilities in that state or the issue of refunding securities based upon the mergers save after a public hearing by the commission, at which a record will be taken of the terms on which the merger is proposed and the methods by which it is proposed to finance the merged companies. Hearings have been held in the past on some applications for mergers, but in many instances the certificates have been issued on statements showing the book values of the properties included in the plan.

President's Power Commission Nominees Not Confirmed as Senate Adjourns

PRESIDENT HOOVER has asked the Attorney-General whether the amendment to the water-power act reorganizing the Federal Power Commission will permit of recess appointments. The President on July 19 sent to the Senate for confirmation the names of Marcel Garsaud of New Orleans, for the three-year term; Ralph D. William-

Marcel Garsaud

son of Washington State, for the two-year term, and Claude L. Draper of Wyoming, for the one-year term. These nominations were reported favorably by the interstate commerce committee, but objection to immediate consideration was voiced by Senator Walsh of Montana and Senator McKellar of Tennessee, on the ground of insufficient information. As a result no one of the nominees was confirmed.

The act reorganizing the commission provides that the new body may function when three of the members shall have taken office, but the phraseology of the act may be found to preclude the usual practice of allowing the President to fill offices during the time Congress is not in session. The fact that the President called upon the Attorney-General so promptly for a ruling on this point indicates that the uncertainty will not be prolonged. This is regarded as desirable, since the old commission does not want to proceed with important matters if new commissioners are to take over the work in the near future.

The act provides that no one may be selected for the commission who is connected with the power business. Evidently it is the President's desire to obtain men for the place who never have been connected with private power companies. In addition, they must be divided as to political affiliation, as to experience, as to groups of thought and as to the section of the country. When all of those considerations must be observed it makes "a picture puzzle that is hard to fit together," as the President expressed it. In case it is necessary for the old commission to carry on until December, the President pointed out that no interest will suffer.

Colonel Garsaud, who was born in France 49 years ago and came to New Orleans at the age of twelve, is one of the outstanding engineers of the South. Until recently he was general manager of the Board of Commissioners for the Port of New Orleans. His duties in that connection were largely of an engineering character. Prior to that time he was chief engineer of the Levee Board of Orleans Parish. He formulated the plans for the twenty-seven-million-dollar lake-front reclamation project which is nearing completion in New Orleans. He was indorsed by the American Engineering Council and by John F. Coleman, president of the American Society of Civil Engineers.

Mr. Williamson is an attorney. While most of his practice has been in connection with reclamation projects, he is very familiar with the water-power situation in the Northwest.

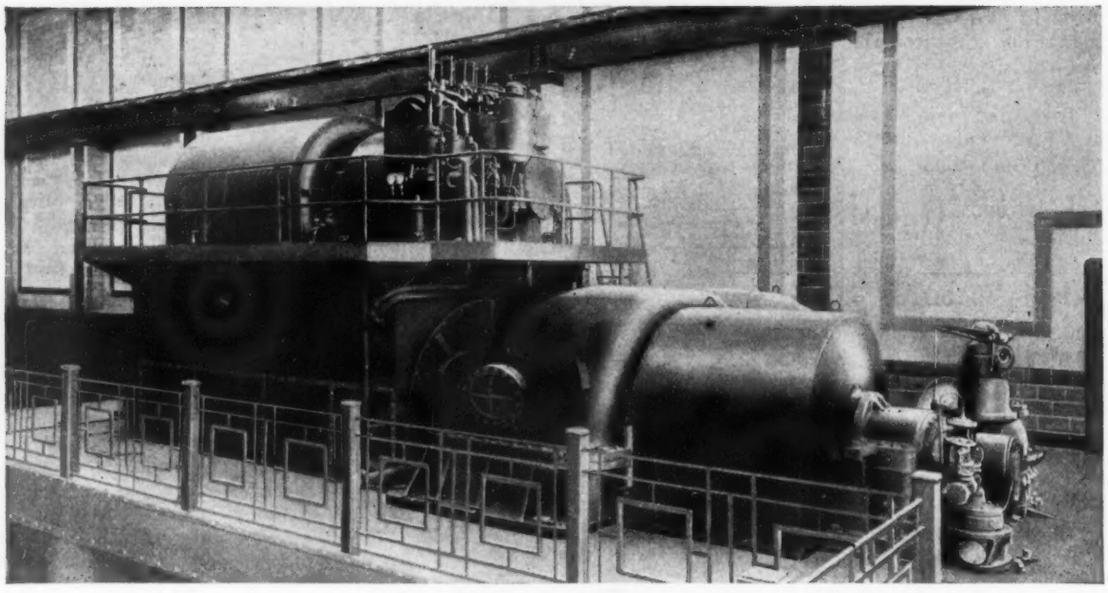
Mr. Draper is the chairman of the Public Service Commission of Wyoming. He has served in that position through three state administrations and he has been active in the National Association of Railroad and Utilities Commissioners.

▼

Iowa Court Against Fairbanks-Morse Plan

ANOTHER state supreme court decision bearing on the right of a municipality to purchase an oil-engine generating plant on the installment basis, paying for it from future earnings, without regard to the constitutional debt limitation, has been handed down—this time in Iowa. In a previous decision in another case, rendered about a year ago, Iowa's Supreme Court seemed aligned with the highest tribunals of Nebraska, Texas and Utah in confirmation of this right. In the latest decision, in which the town of Sidney and Fairbanks, Morse & Com-

VERTICAL COMPOUND UNIT FOR NEW JERSEY



Last year the ELECTRICAL WORLD *reported the design by General Electric engineers of a new-type vertical-compound turbine in which the high-pressure element was to be mounted above the low-pressure. The Pacific Gas & Electric Company ordered two of these, rated at 50,000 kw. each, and Henry Ford one, rated at 110,000 kw. At the Perth Amboy station of the Jersey Central Power & Light Company such a machine, rated at 25,000 kw. and operating at 1,250 lb. pressure, has just been installed.*

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pany are concerned, the court aligns itself with the Supreme Court of Idaho, where early this year a similar adverse decision was handed down. The court says:

The contract under consideration provided for the sale of this machinery to the city, to be paid for by pledge orders as thereinbefore specified. The question therefore is, had the city the power to make the contract under consideration for the purchase of said machinery to be paid for as therein specified? That it had the power to purchase machinery of this character cannot be questioned, but did it have the power to make a contract in which it agreed to pay for said machinery through pledge warrants, supported by an ordinance pledging such machinery and the net income from a plant to be constructed to the payment of such pledge warrants on future dates? Under the provisions of the above-quoted statutes, no such power is specifically or expressly given, and if such power exists, it must be implied. It is also true that, when the right is claimed under an implied power to do a thing in a certain way, it must be absolutely necessary that it should be done in that way in order to exercise the power conferred. If it is not thus necessary, the fact that it is convenient or useful to do it in that way will not authorize presumption of implied power.

Applying these rules to the case before us, the fact that it may be useful or convenient to the corporation to buy this machinery and pay for it by pledge warrants will not authorize the conclusion that it has the implied power to do so, because it is not absolutely necessary to attain the end sought, the statute providing that it may issue bonds and pay by taxation.

Kansas City Company's View of Power Situation

KANSAS CITY, MO., and Kansas City, Kan., as well as the environs of both, would benefit greatly from a unified power system with a total generating capacity of 450,000 kw., equally divided between the Kansas City Power & Light Company's Northeast plant, its Second Street and Grand Avenue plant and an enlarged plant superseding the present municipal plant across the river in Kansas.

This is the deduction from the story told by the power and light company in a full-page newspaper advertisement with a chart showing the present lines and indicating the possible connection of its station with that of the Kansas municipality. The map, the company says, may "furnish an answer to the question, 'Why does Greater Kansas City grow industrially in spots?'" Any aggressive designs on the municipal property are, however, specifically denied, the company saying:

The Kansas City Power & Light Company stands ready now, as always, to purchase any municipal properties within its trade area. We are not now and will not engage in any campaign of embarrassment of municipal properties with the view of forcing an expression on a sale of such properties by the people owning them.

On December 29, 1926, we made a tentative offer to acquire the Kansas City (Kan.) electric property. We will resume negotiations when the people themselves or their accredited representatives express a willingness to sell. The Kansas City Power & Light Company is in a position to give the best price and the best service of any utility group in this territory. But, the Kansas City Power & Light Company will not become directly or indirectly a party to a campaign of harassment.

R. H. Jarvis, vice-president Western Power, Light & Telephone Company, which desires to buy the municipally owned plant, has announced that of 15,000 post cards returned to his office by Kansas City (Kan.) taxpayers, 38 per cent favor sale of the plant.

▼

Wisconsin Electric Men Assemble at Madison

FOLLOWING the address of Chairman D. G. Evans, delegates to the annual meeting of the Electric Section of the Wisconsin Utilities Association at Madison, July 17 and 18, heard practical papers and addresses on the public utility business, lightning protection, power-factor correction, trends in water-heating and other rates, the revised code, relations with customers, transient voltages and the development of good linemen. President M. H. Frank of the association spoke on Friday.

E. J. Kallevang, Wisconsin Power &

Light Company, Madison, was elected chairman of the section and W. E. Schubert, Wisconsin-Michigan Power Company, Appleton, vice-chairman.

▼

Three Section Heads for N. E. L. A. Appointed

PRESIDENT JONES and his coadjutors at National Electric Light Association headquarters have made progress in the selection of chairmen for national sections and committees. Harry Reid, New York, chairman of the Public Relations National Section, and Alex D. Bailey, Chicago, chairman of the Engineering National Section, have accepted reappointment. Franklyn Heydecke, Public Service Electric & Gas Company, Newark, N. J., will head the Accounting National Section, in succession to W. R. Emerson of Oklahoma City. The fourth section chairman—to succeed Marshall E. Sampsell as head of the Commercial National Section—has not yet been appointed, nor have the chairmen of bureaus and committees in that section or of committees in the Accounting and Engineering sections.

Chairmen of special national committees, of general national committees and of committees in the Public Relations National Section have been named as follows:

Special National Committees

Charles A. Coffin Prize—W. Alton Jones, New York.
Codes and Standards—Irvin W. Day, Waterbury, Conn.
Constitution and Bylaws—R. F. Pack, Minneapolis.
Exhibition—E. W. Goldschmidt, New York.
Finance—Sidney Z. Mitchell, New York.
Lamp—Frank W. Smith, New York.
Public Policy—P. S. Arkwright, Atlanta.
Prize Awards—Frank W. Smith, New York.
Rate Research—L. R. Nash, Boston.

General National Committees

Civic Development—John B. Reynolds, Chicago.
Insurance—W. H. Sawyer, New York.
Membership—A. Jackson Marshall, New York.
Rural Electric Service—Eugene Holcomb, Jackson, Mich.

Public Relations Committees

Advertising and Publicity—Joseph B. Groce, Boston.
Co-operation with Educational Institutions—John F. Gilchrist, Chicago.
Customer Ownership—James B. Black, New York.
Industrial Relations—Homer E. Niesz, Chicago.
Public Speaking—W. S. Vivian, Chicago.
Relations with Financial Institutions—Charles B. Stuart, New York.
Women's—Miss Clara Zillessen, Philadelphia.

All the above are reappointments except in the case of the advertising and publicity, customer ownership and women's committees of the Public Relations Section and except that President Jones succeeds Past-President Sloan as head of the Coffin prize committee.

▼

Three Engineers to Guide Los Angeles' Power Course

APPROVAL has been given by the Los Angeles Board of Water and Power Commissioners of the Chamber of Commerce's selection of three engineers to make a survey and report on the city's proposed power development program from an engineering standpoint.

The Bureau of Power and Light wishes to place on the ballot at the primary election, August 26, a measure authorizing a bond issue of $19,000,000 as a part of a tentative three-year financial program totaling $31,000,000, $12,000,000 of which is to be derived from power revenue.

The engineers chosen by the Chamber of Commerce are W. F. Durand, emeritus professor of mechanical engineering, Stanford University; R. W. Sorenson, professor of electrical engineering, California Institute of Technology, and A. V. Guillou, assistant chief engineer of the California Railroad Commission.

Vast Undeveloped Water Power of Idaho

IDAHO has barely touched her water-power resources, and the undeveloped possibilities make one of the state's greatest assets, a report of the Bureau of Reclamation says. The state has a potential power development of 2,122,000 hp. available 90 per cent of the time, and 4,032,000 hp. for 50 per cent of the time, based on an over-all efficiency of 70 per cent. Only 357,833 hp. is now harnessed.

The Snake River is credited with having far the most undeveloped power as well as developed output, but the Salmon River follows as a hard-racing second. Between the Milner Dam and Weiser on the Snake River the report estimates that 250,700 hp. could be developed 90 per cent of the time, while between Huntington and Lewiston 919,000 hp. could be developed.

There are in the Boise River Basin 25 power sites at which 44,200 hp. can be developed for 90 per cent of the time and 72,000 hp. for 50 per cent.

The Payette River and its tributaries are credited with 118,000 hp. The Salmon River, like the Snake, is divided into two sections, that between Stanley and Salmon being credited with a potential 83,000 hp., while from Salmon to the mouth it is estimated 590,000 hp. could be turned out. On 40 sites on the Clearwater 184,000 hp. is available.

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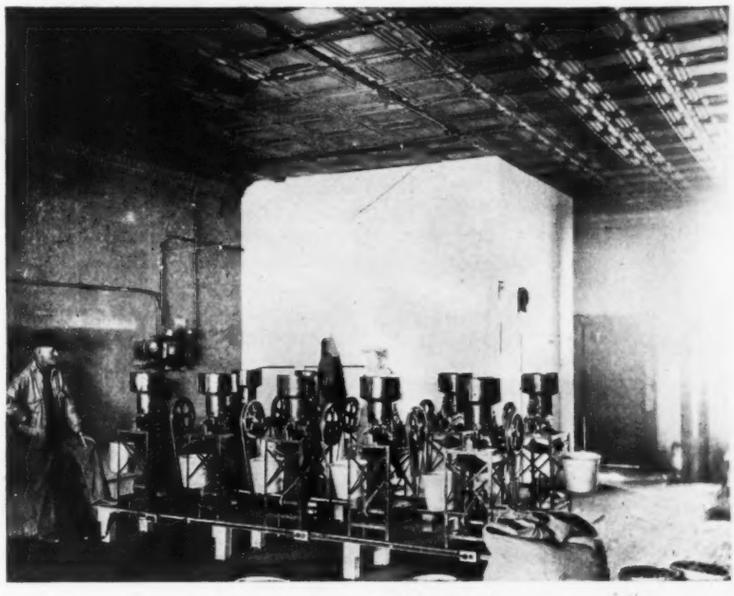
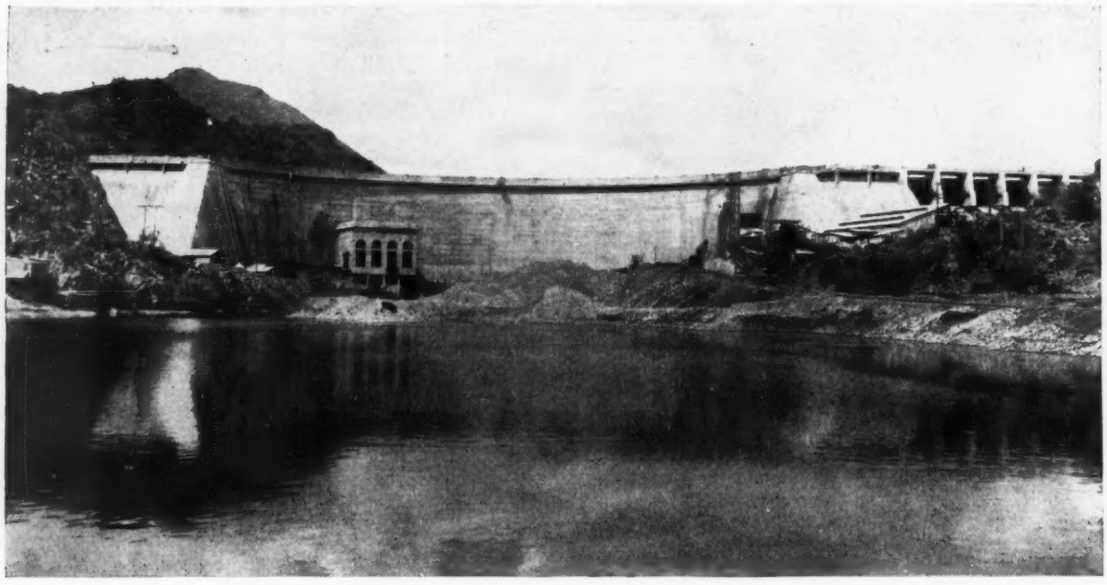
NUT-CRACKING ON A PRODUCTION BASIS



These electric machines in a Hugo (Okla.) factory are cracking pecans for the praline trade. Miniature ones would be welcome in many homes on Christmas morning.

ELECTRICITY AND IRRIGATION CLOSE ALLIES IN ARIZONA



This view of Stewart Mountain dam and power house, fourth step in the Salt River Valley Water Users' Association's development project in Arizona, was taken immediately after their completion. The dam is 180 ft. above bedrock and 1,200 ft. long over all, with a 400-ft. spillway. Installed capacity of the power house, shown below the dam on the left, is 12,000 hp.

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Inland Power & Light Keeps Lewis River Sites

A RULING by the Supreme Court of Washington State, handed down July 8, sustains the appropriation of waters from the North Fork of the Lewis River by the Inland Power & Light Company. The opinion affirms the Clark County Court, which dismissed the objection of George N. Funk to the granting of the water permit. The power company obtained permission to build power sites at Ariel and Yale, damming the river at each place. The plaintiff, who owns timber land above Yale, protested because with the damming of the river he could not float his logs down to the Columbia.

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Electragists Will Meet at Milwaukee Next Month

MEETING at Milwaukee in annual convention from August 18 to August 20 inclusive, the Association of Electragists International will on the second Tuesday discuss the electrical modernization of industries as presented by Louis Kalischer, E. A. Steinbuchler and H. H. Balkan. Trade practice rules will be another subject. It will be presented by L. K. Comstock and discussed by men within and without the ranks of the Electragists. President W. A. Jones of the N.E.L.A., O. Fred Rost, A. Penn Dunton and Clarence L. Collens are among the other speakers announced to present practical topics.

▼

Arizona Edison Helps Salt River Water Users

POWER for electrical pumping of water to irrigate additional lands in Arizona has been arranged for under a 25-year contract concluded between the Arizona Edison Company and the Salt River Valley Water Users' Association, both with headquarters in Phoenix. The lands lie about 25 miles south of Phoenix, Tempe and Mesa, and the total area eventually to be irrigated is about 170,000 acres, of which 20,000 will be put under cultivation as soon as the installation is ready.

The company will serve the pumps with power bought from the Water Users' Association, which will build the power lines and substations. The extension program involves the building of a 110-kv. transmission line at an estimated cost of $188,725 and a transformer substation at its terminus at an estimated cost of $126,000. Construction will start early in August, it is expected.

New York Commission's View of New Legislation

JEALOUS determination not to allow utilities to weaken their control by the New York Public Service Commission is evinced by the refusal of that body to permit the Brooklyn Union Gas Company to sell a coke-oven plant recently erected at a cost of $16,000,000 to the Brooklyn Coke & Byproducts Corporation, a subsidiary of the Koppers Company, controlled by the Mellon interests, and thus a "foreign" corporation outside the jurisdiction of the commission.

According to the commission's own summary of its decision, the latter contains the first official interpretation of the law passed by the last Legislature bearing on control of holding companies. Chairman Milo R. Maltbie in this summary says that the limited jurisdiction afforded by the law referred to "would be entirely inadequate to deal with the present situation" and that, notwithstanding that the Koppers Company owns a considerable amount of stock in the Brooklyn Union Gas Company, the law "by no means gives to the commission the same jurisdiction over the coke-oven company that it now has over the gas company." Consent is refused to the transfer on the ground that it is not in the public interest to place the plant outside of the commission's juris-

diction, where it was placed by statute, and that the granting of the petition would virtually nullify enactment of the New York Legislature.

▼

Holding-Company Data Denied State Commission

A PRELIMINARY injunction was issued on July 11 by a three-judge statutory court at Concord, N. H., against the New Hampshire Public Service Commission, restraining the commission from requiring certain information from the New England Gas & Electric Association and the Associated Gas & Electric Company. The commission, however, was empowered to obtain information from the New Hampshire Gas & Electric Company and the Derry Electric Company, both of which operate within the state. The commission contended that the two last named utilities are affiliated with the others and that the operations of the holding companies are reflected in the rates of the New Hampshire companies.

The investigation of the local utilities will continue, it was stated orally by the chairman of the commission, Mayland H. Morse, who added that "at some time the commission will apply for dissolution of the temporary injunction and in doing so will presumably submit additional evidence some of which it may secure from its investigation of the New Hampshire companies."

The legal right of the insurance commissioner of New Hampshire to suspend, allegedly without notice or hearing, for sale within the state the $20,000,000 bond issue of the New England Gas & Electric Association is involved in another proceeding pending in the United States Court for the District of New Hampshire.

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Permit Sought for Northwest Sites—Missouri Acts

APPLICATION has been made by the Great Northern Power Company of Seattle to the Federal Power Commission for a preliminary permit covering a 300,000-hp. project on the Sultan, East Wallace and Olney Rivers, North Fork of the Skykomish River, West Cady Creek and Troublesome Creek, in the State of Washington. The plan of development involves combining the water by means of tunnels and conduits so as to form a reservoir on the West Fork of Wallace River. It is to be led thence through power houses on Wallace River and on the Olney River. There will be reservoirs also on Skykomish River and on its North Fork. That water will pass through a third power house on the Skykomish River. It is proposed to install 600,000 hp., or twice the primary capacity of the site. It is expected that the commission will inquire carefully into the prospective market to be supplied by this project, in view of the fact that the Rock Island site on the Columbia River was recently licensed.

Attorney-General Stratton Shartel of Missouri has asked the Federal Power Commission to postpone the issuance of any new permits affecting Missouri streams until the state is able to pass legislation designed to regulate the development of water power within its confines.

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New Utility Offices for Four Large Cities

FOUR more at least will soon be added to the many attractive office structures erected by light and power companies in the larger cities of the nation.

At Washington plans for the two-million-dollar nine-story brick, limestone and granite home of the Potomac Electric Power Company, at the northeast corner of Tenth and E Streets, N.W., were adopted some time ago. Parking space in the basement for employees' automobiles and all-electric model homes on the second floor will be features. Executive offices will be on the eighth floor, while the ninth, or setback, floor will be devoted to recreational facilities.

The Kansas City Power & Light Company will build a skyscraper on the northwest corner of Fourteenth Street and Baltimore Avenue. The design filed is for a 501-ft. building without setbacks at front or rear. Thirty stories will be available for offices, the building proper being surmounted by a 41-ft. penthouse, on top of which will be constructed an ornamental tower 87 ft. high. Beacon lights are to be installed in the tower. Only 20 floors, however, may be built this year.

Excavation has been completed and footings are being set for the erection of the new eighteen-story, electrically welded steel office building of the Dallas Power & Light Company. The structure, which will represent an investment of $1,250,000, is to be eighteen stories high and will be the tallest electrically welded structure in the world. Only a portion of the building will be occupied by the central offices of the company, the remainder being leased until such time as it may be needed. A two-story building will join the eighteen-story structure, making the building accessible from two streets.

Construction began recently on a new office building for the Northern States Power Company at Fifth and Wabasha Streets, St. Paul. It will be six stories in height, of modern skyscraper design, built of reinforced concrete with stone finish and ornamental exterior design. It will have modernistic interior lighting and exterior floodlighting. The first floor is expected to be ready for occupancy on December 1.

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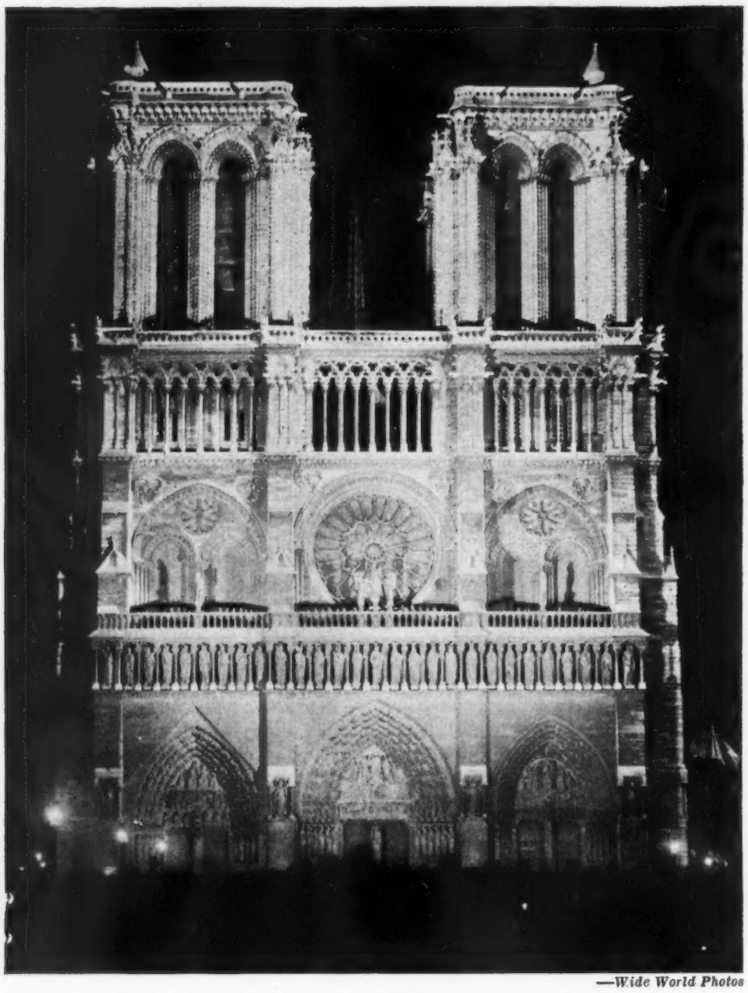
COMING POTOMAC ELECTRIC BUILDING

Work is progressing on sculptured plaques, depicting the progress of electricity, which will form a decorative frieze around the office building under construction for the Potomac Electric Power Company of Washington. There will be eighteen of these pieces, each devoted to an electrical pioneer. The eighteenth will bear the likeness of Edison.

MODERN LIGHT ON ANCIENT CHURCH



—Wide World Photos

France, which takes its drama and literature seriously, has just celebrated the centenary of the romantic movement that was headed by Hugo, Dumas and other young revolutionaries. As an incident in the celebration the Cathedral of Notre Dame at Paris was floodlighted for the first time. Five hundred floodlamps were used.

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Private Ownership Gains in Saskatchewan

RIVALRY between privately and publicly owned power plants in the Canadian province of Saskatchewan is keen, with the former showing some gain. At the present time, of 157 plants and systems in the province, no less than 133 are controlled or owned by private companies. Of the more important cities, Regina has municipal ownership, Saskatoon has sold its own plant to the Saskatchewan Power Commission, while Moose Jaw has sold out to the Iowa Southern Utilities Company.

Another municipal electric plant, that at Swift Current, will become part of the Saskatchewan Power Commission system following the decision of the City Council to accept the commission's offer of $200,000 for the plant, the city retaining the distribution system. The sale of the Swift Current plant is an outcome of negotiations announced by Premier Anderson last April with Prince Albert, Swift Current and North Battleford. The North Battleford plant has also been acquired.

While the plants owned by the municipalities and the power commission are in the main scattered and unrelated, private companies are achieving success in building up well-correlated systems.

Municipal plants exist in fourteen different cities, towns and villages, with a total valuation of $4,473,595, of which $2,800,000 is that of the Regina plant. Total valuation of the Power Commission's plants is $2,877,492, of which $2,597,848 is the valuation of the Saskatoon plant. Compared with private holdings, valuations are as follows: Commission and municipalities, $7,341,-087; private holdings, $9,854,000.

Latest information in connection with the proposal to develop about 90,000 hp. at Horse Shoe Bend, on the North Saskatchewan River, a few miles from Prince Albert, is that Montreal interests back of the project are asking approval from the Saskatchewan Power Commission. It is understood that the promoters do not intend to distribute energy, but will sell the power to the commission for delivery at the busbar, both Prince Albert and Saskatoon, 100 miles distant, being supplied.

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S.P.E.E. Elects Officers for New Year

OFFICERS elected for the coming year by the Society for the Promotion of Engineering Education at its recent annual meeting, held in Montreal, were: President, H. S. Boardman, president University of Maine, Orono, Me.; vice-presidents, C. F. Harding, Purdue University, Lafayette, Ind., and R. A. Seaton, Kansas State Agricultural College, Manhattan, Kan.; treasurer, W. O. Wiley, New York City; secretary, F. L. Bishop, University of Pittsburgh. The 1931 meeting will be held at Purdue University next June.

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Abolishing Malaria at Furman Shoals Site

HEALTH work being undertaken by the Allied Engineers in the construction of the Furman Shoals hydro-electric plant near Milledgeville, Ga., is not only reducing illness among the thousand workers to a minimum but is wiping out malaria among the natives of the district. An anti-malaria laboratory has been established at the Georgia State College for Women, 4 miles from the site of the dam, and trained workers are touring a wide section around the camp, giving blood tests and supplying anti-malaria treatments to all who need them.

The 12,000-acre lake site is being cleared of brush and shrubbery, and later, as it fills, oil will be sprayed on the surface at regular intervals to aid in the destruction of mosquito larvæ.

The Furman Shoals development will be one of the largest hydro-electric plants in Georgia, with a rating of 60,000 hp. The dam is to be 2,960 ft. long and 90 ft. high, and the lake is to be 38 ft. deep and 1,500 ft. wide. The Georgia Power Company will own the plant.

Utilities in Three States Plan Rate Reductions

REDUCTIONS in rates for domestic and commercial energy to benefit the entire western and central Washington territory served by the Puget Sound Power & Light Company have been made. The reduction of ½ cent per kilowatt-hour applies in all territory where the present rate is 8 cents. The new rate will be effective after August 1 and is to be followed on March 1 next by a further reduction ranging from ½ cent to 1 cent per kilowatt-hour. President Leonard announces that the rate cut is the forerunner of a series and that the high rate will not exceed 5½ cents in 1932. The present reduction is not effective in Seattle, Tacoma or other cities where the present rates generally are below the 8-cent maximum.

Application for permission to reduce electric rates for all classes of service in its northern Virginia territory has been made to the Virginia Corporation Commission by the Virginia Public Service Company. If the reductions are granted, they will go into effect September 1. At present there are 20 or 30 different rates in effect. A total reduction of approximately $400,000 is estimated.

A petition asking the Arkansas Railroad Commission to establish standard rates for electric service which would materially reduce the present cost to rural consumers on a dozen or more thickly populated highways leading out of Little Rock has been filed with the commission by the Arkansas Power & Light Company, and a hearing has been set for September 3. At present the company has separate contracts with each consumer, the monthly minimum charge ranging from $1.50 to $2, with the excess varying from 10 to 18 cents per kilowatt-hour. The new uniform rates would apply to residential and business concerns on the principal pikes and highways out of Little Rock within 100 yd. of the rights-of-way. Present rural rates would be continued in effect in other sections.

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Coming Meetings

Wisconsin Utilities Association—Commercial Section, Green Bay, July 31 and Aug. 1. J. N. Cadby, 105 Wells St., Milwaukee.

Camp Co-operation X—Association Island, Henderson Harbor, N. Y., July 31-Aug. 4. Society for Electrical Development, 420 Lexington Ave., New York.

Association of Electragists International—Hotel Schroeder, Milwaukee, Aug. 18-20. L. W. Davis, 420 Lexington Ave., New York.

Institute of Radio Engineers—King Edward Hotel, Toronto, Aug. 18-21. H. P. Westman, 33 West 39th St., New York.

International Association of Electrical Inspectors—Northwest Section, Bellingham, Wash., Aug. 25-27. F. D. Weber, 414 Lumbermen's Bldg., Portland, Ore. Western Section, Congress Hotel, Chicago, Sept. 15-18. W. S. Boyd, 175 Jackson Blvd., Chicago. Eastern Section, Pittsfield, Mass., Sept. 22-24. R. Walker, 85 John St., New York.

American Institute of Electrical Engineers — Pacific Coast convention, Portland, Ore., Sept. 2-5; Middle Eastern district, Philadelphia, Oct. 13-15. F. L. Hutchinson, 33 West 39th St., New York.

Pennsylvania Electric Association—Bedford Springs, Pa., Sept. 3-5. Harold A. Buch, Telegraph Bldg., Harrisburg, Pa.

Empire State Gas and Electric Association—Saranac Inn, N. Y., Sept. 18 and 19; Meter Section, Watertown, N. Y., Oct. 9 and 10. C. H. B. Chapin, Grand Central Terminal, New York.

Great Lakes Division, N.E.L.A.—French Lick Springs, Ind., Sept. 25-27. T. C. Polk, 20 North Wacker Drive, Chicago.

American Electrochemical Society — Hotel Statler, Detroit, Sept. 25-27. C. G. Fink, Columbia University, New York.

National Safety Council—Pittsburgh, Sept. 29-Oct. 4. W. H. Cameron, 20 North Wacker Drive, Chicago.

New England Division, N.E.L.A.—New Ocean House, Swampscott, Mass., Sept. 29-Oct. 1. Miss O. A. Bursiel, 20 Providence St., Boston.

Illuminating Engineering Society — Hotel John Marshall, Richmond, Va., Oct. 7-10. E. H. Hobbie, 29 West 39th St., New York.

Rocky Mountain Division, N.E.L.A.—Franciscan Hotel, Albuquerque, N. M., Oct. 20-22. O. H. Weller, Public Service Co. of Colorado, Denver.

Submetering as Viewed by New York City Court

SUBMETERING in New York City, which attracted much public attention a year or more ago when President M. S. Sloan of the united Edison companies in the greater city advocated the abolition of the practice, which, he said, stood in the way of a substantial rate cut, came up again recently, not this time before the Public Service Commission or the legislative investigating commission, both of which have canvassed it, but in a municipal court.

Here a landlord brought suit because his tenant refused to pay him for electricity consumed, the lease making such a payment obligatory. The court held that the plaintiff could not recover because his business as a landlord was incorporated under the general business corporation law and was therefore exempt from regulation by the New York Public Service Commission. This deprived his tenants, the court held, of the right of appeal to the commission. If the landlord desired to conduct an electrical business, continued the judgment, he should incorporate under the transportation corporation law, thus bringing himself under commission jurisdiction, and it would first be decided whether or not a certificate of convenience and necessity should issue.

PHOTO-ELECTRIC TUBE HELPS WAITERS

Need for acrobatic stunts by waiters confronted with swinging doors has been obviated by a new application of the photo-electric tube by the General Electric Company. A ray of light is focused on a tube in front of the door and a few feet distant. When this ray is intercepted by the approaching waiter a hydraulic door opener operates.

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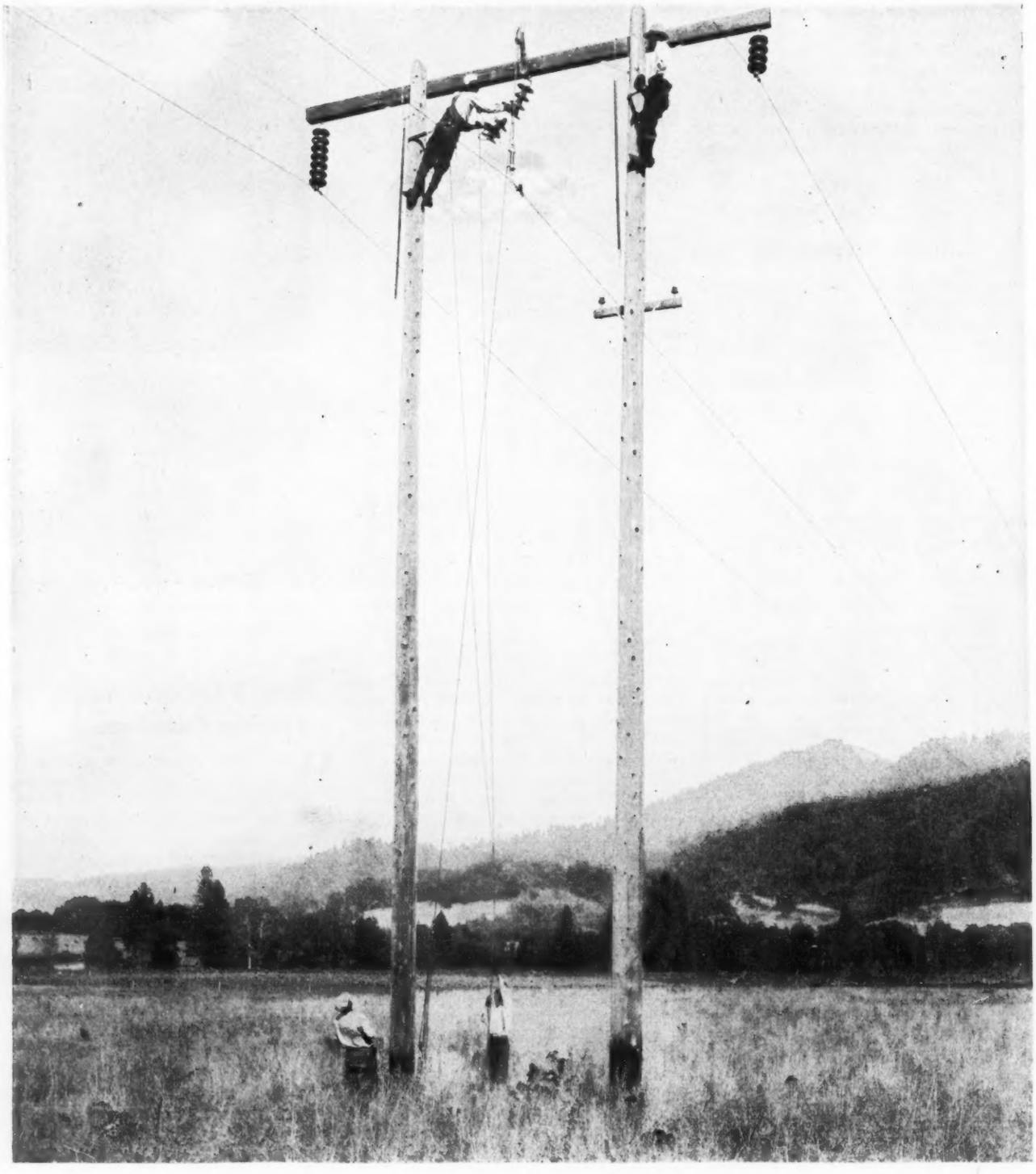
Fresno Officials May Emulate Pasadena's

WHAT is intended as a tentative step toward municipal ownership of gas and electric utilities in Fresno, Calif., has been taken by officials of that city in opening negotiations with three large California oil companies for options on gas lands sufficient to supply not only the gas needs of the community but the electrical needs as well through the use of natural gas as fuel in generating electrical energy.

The decision to obtain proposals for options on gas property was arrived at by the City Commission following a meeting in Tulare, Calif., at which B. F. DeLanty, general manager of the Pasadena Municipal Light and Power Department, told of success achieved there in using natural gas in the generation of electricity. Large profits are asserted to have been realized in the past 23 years.

REINSULATING HOT LINES IN CALIFORNIA



EDITORIALS

L.W.W.MORROW
Editor

Look for Engineering Alternatives

AN ENGINEER can never afford to cease cultivating perspective as he applies his specialized knowledge to projects upon which he is employed. Respect for what others have established is well enough, but from the outset the habit of trying to see all around a problem, as well as through it, should be assiduously developed.

Thus, in the development of interconnections, expansion of distribution systems, design of substations and other system components the search for alternative solutions of problems, whether large or small, should be unremitting. Even older engineers vary greatly in their attacks upon such problems, and one of the marks of the practitioner of high repute is a breadth of vision and of understanding which will not accept the apparently obvious solution as the best until a thorough study has been made of the alternative possibilities. The younger subordinate engineer may have no authority and small opportunity to influence the final decision as to the method or layout, but no chance should be lost to study and discuss alternatives among his fellows and, when acceptable, with his immediate superiors.

What is vital is that each engineering organization should become imbued with the questioning point of view. Easy-going acceptance of the idea that all previous layouts and installations represent the most nearly correct engineering solutions for the situations covered should give way to a fresh search for alternatives, bearing changing conditions constantly in mind. In the vigorous war on excessive overhead costs now being waged by the best engineers such methods may win lasting victories.

Scenery Preservation and the Federal Power Commission

ASSUMING that Attorney-General Mitchell has rightly interpreted the water-power act, scenery preservationists have been directing a prodigious amount of public-spirited barking up a wrong tree. Their repeated requests that the Federal Power Commission deny licenses to projects held to be destructive to natural beauty are now officially declared to be irrelevant; for, the government's law officer says, the commission's protective powers relate to navigation only and cannot be extended to the esthetic or recreational aspects of power sites.

Unless Mr. Mitchell's view is reversed or Congress shall extend the authority of the commission, vetoes on esthetic grounds, where power is concerned, can henceforth be exercised only by the legislatures of state or nation, with possible conflicts and reversals in the courts. However, Kentucky's course on Cumberland Falls and that of Congress on the Potomac project may, if finally sustained, serve as precedents for opposition. Points of view are too far apart for easy compromise. Every case differs from every other, and to decide each on its real merits greater enlightenment, both technical and artistic, than has yet become common would have to prevail.

One thing is clear enough. In localities where water power has little economic advantage over steam and where there is a genuine public desire that falls be let alone would-be builders of dams may profit by the example of the Colorado company which a year or two ago, facing popular clamor over its plan to take power from the scenic Arkansas, gracefully receded and left the Royal Gorge as time and nature made it.

Away with Commercial Complacency!

HOW easy it is to settle back into one's chair after luncheon and benevolently regard the growth of the power industry! The statistics are indeed marvelous; the field of commercial development is widening from day to day, and the progress of electricity seems limitless. Surely we have come a long way from the pioneer days. The public accepts our service as a vital necessity —takes it much for granted, in fact. Will not the natural increment of growth occupy us for many years to come? All this is beyond denial, but within such complacency lie the seeds of inadequate development, sluggish policies and, surely, if long continued, popular dissatisfaction and resulting industry distress.

Without sufficient and adequately trained sales personnel, the power industry cannot attain a quarter of its potential usefulness to the public. Better men and more of them are demanded. Methods of approach to customers, of analysis and of contact maintenance must be improved in numerous areas of service. Incomplete sales engineering information and superficial presentation must give place to carefully gathered facts, soundly interpreted and offered to the customer, actual or prospective, according to a definite plan of procedure. Competition must be faced without "kidding" one's self as to costs. Only so can business be continually held and built to larger totals. In a word, commercial activities must become in a sense professional.

Consider the Lamp

WHAT a poor showing every domestic electrical device makes when compared to the electric lamp! These marvels of mass production are uniform in quality, in length of life, in maintenance cost and are sold at a marvelously low price.

Why cannot a similar result be brought about in the field of appliances? The market for mass production is available, yet mass production on the scale and quality of that found in the electric lamp is missing. The utilities and the manufacturers go along content with poor appliances, fractional sales, high prices and high maintenance and replacement costs. A manufacturer who wishes to do the right thing cannot compete and cannot find a distribution mechanism suitable for mass production operations. As a result, the general plane of quality in the appliance field is measured by the query, Is it competitive as to price and service?

No one advocates a plan for appliances that embodies the identical mechanism for manufacture and distribution that exists for electric lights. But surely some way can be found to get the same results as regards production, quality and sales in the appliance fields. In the sale of appliances pace is not being kept with the growth of customers. The production and distribution methods are of all kinds and types and equally expensive and ineffective, and the quality of appliances is far below that which customers could have. There is much to gain and nothing to lose by considering the electric lamp.

When Are Outdoor Installations of Rotative Equipment Justified?

OUTDOOR installation of non-rotative equipment has become so commonplace where ground space is not at a premium that it is the usual method of minimizing housing expense, providing for growth, avoiding congested layouts and removing indoor hazards arising from faulty equipment or oil fires. So many outdoor installations of rotative equipment also have been made in recent years or are under construction that the question arises how far this movement may extend.

So far the outdoor installations of rotative equipment have consisted chiefly of synchronous condensers, although semi-outdoor hydro-electric generators are installed and an installation of outdoor frequency changers is planned for the Reading Railroad at Wayne Junction, Pa. Manufacturers point out that hydrogen cooling of units makes them inherently adapted to outdoor use, and their representatives recently declared at an N.E.L.A. electrical apparatus committee meeting that 1,200-lb. steam boiler, turbine and generator installations could be easily adapted to weather exposure.

Provision for maintenance and repair and protection of the lubricating oil during cold weather were two problems that retarded wide acceptance of outdoor installations when first considered, but various methods of handling these problems have been developed. Whether the operator's requirements for maintenance can be extended to other rotative equipment seems to depend chiefly on designers' ingenuity.

While the installations which have been made would indicate that sufficient advantages have accrued from outdoor installations to offset the expense of providing for the changed operating conditions, each case must still be considered an individual problem in economics. How much saving can be made in building structures by placing equipment outdoors? And to what extent will this saving be offset by protection against the weather and providing for maintenance and repair?

Corona Loss Erratic

CORONA-LOSS measurements at 220 kv., just completed at Stanford University under conditions simulating actual field operation, have disclosed the fact that corona loss is very erratic. The loss with conductors which have weathered only one week has been as much as ten times that of the conductors when first installed. Although dirt increases the loss, grease decreases it. Rain and humidity appreciably affect the loss. Little difference was observed in the results obtained with aluminum and copper of the same diameter and similar stranding in the outer layers, and vertical or horizontal configuration had little effect.

While it has been known for some time that the surface condition of conductors affects corona loss, it was not evident before these tests that losses varied over such a wide range. Contrary to opinion, it was found that weathering or oxidizing of the surface has a much greater bearing on losses than does the nicking or scratching received in the course of stringing. The fact that a greasy surface decreases losses leads to an interesting speculation. What are the possibilities of reducing losses by enameling high-voltage conductors or applying a non-oxidizing, non-corrosive surface by chemical or metallurgical process? Assuredly here is a field for further research.

Complexity of Industrial Control Diagrams Hampers Applications

THE average diagram of an industrial control circuit is notoriously difficult to follow and to interpret. Why this should be so is not quite clear, because after all an industrial control diagram contains three basic features, namely, push buttons, contactors and controllers, all comparatively simple devices and easy to show diagrammatically.

Certainly the electrical system of a modern power house contains as complicated a combination of automatic devices and wiring schemes as it is possible to imagine. With all the instruments, relays, regulators and control devices employed there, it would be expected that the wiring diagrams would be almost impossible to follow. Still, such connection diagrams are now so made that every wire can be easily traced and the function of every instrument can be readily discerned. Not so with industrial control diagrams.

The inherently much simpler industrial control diagram always appears to be mysterious to any one except perhaps to the very few who prepare them. The reason is that the method of making power-house switchboard diagrams has been systematized and rationalized. The system of symbols is so simple that a key is hardly required, and the diagrams contain a liberal amount of notes to explain all doubtful points. On the industrial control diagrams the equipment is generally shown scattered all over the sheet without any system, the symbols are unnecessarily complicated and there is a scarcity of notes. In some cases factory electricians have hesitated to use automatic controls, no matter how simple, because the diagrams make them appear much more complicated than they really are.

It is very essential that these diagrams be made much simpler and clearer than they are now. This task of restandardizing should be turned over to such men as those who have been so wonderfully successful in rationalizing the power-house switchboard diagram. It should not be at all surprising if better diagrams, in addition to all other obvious advantages, lead to actual simplification of industrial control equipment, as actually happened quite frequently in the case of switchboards. Simplification means greater use.

Guiding Expansion of Load-Dispatching

SYMMETRICAL development of load dispatching as a power system expands is essential to the clear-cut handling of service responsibilities over ever-widening areas. The tremendous growth of the New England Power Association within the last three years has necessitated the provision of a greatly enlarged operating organization to enable the dispatching department to exercise proper control of plants, lines and interconnections now inseparably involved in its efficient and reliable service.

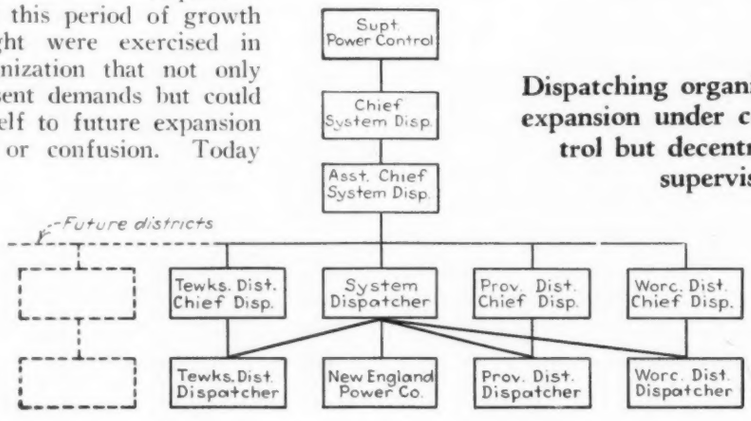
THE chief system load dispatcher of this organization tells, in this paper,* how this branch of company activity has been developed along the lines of local decentralization combined with headquarters direction and co-ordination of load handling and operating analysis.

THREE years ago the New England Power Company system faced the problem of successfully directing the development of its load-dispatching organization to meet the requirements of system expansion. At that time one dispatching office sufficed, complete load allocation and switching being centralized at this point. Today four offices are organized and functioning, one of which acts as the headquarters of supervision. During this period of growth great care and foresight were exercised in order to erect an organization that not only would care for the present demands but could readily accommodate itself to future expansion without reorganization or confusion. Today a dispatching organization exists which we feel can grow with the system.

Our dispatching organization has been based primarily on three requirements: (1) Complete centralized load designation and control by system dispatchers; (2) delegation of localized system operation to district dispatchers and (3) unified system and district dispatchers' activities.

The first requirement, "complete centralized load designation and control by system dispatchers," has been found not only desirable but necessary. In it we find a means to attain ultra-efficient operation, since it places no limit on what can be done. With the growth of system load and the frequent construction of additional plants comes the problem of properly allocating production to obtain best operating efficiency at minimum cost. Load designation and control cannot be accomplished by calculation alone, although calculation plays the important part. It is somewhat like the Weather Bureau. We calculate and forecast the load, but, unlike the Weather Bureau, our work does not end there, as we follow the trend and adjust conditions to meet a deficiency in the forecast. Aside from the forecast of load, a systematized forecast of river flows is established, with allowances made for weather conditions. When all estimates are completed they are incorporated into the load forecast, together with the spare capacities reserved for emergency purposes. Studies must be made of supply and demand, possible savings to a fraction of a mill made an actuality, water economies created by more efficient hydro loadings and system losses reduced by the removal from service of apparatus not required for capacity. All this is only a small part of load control, and it is readily seen that to obtain not only efficient operation but co-operative operation centralization is essential.

All forecasting is done at Millbury and the system dis-



Dispatching organization permits expansion under centralized control but decentralized local supervision

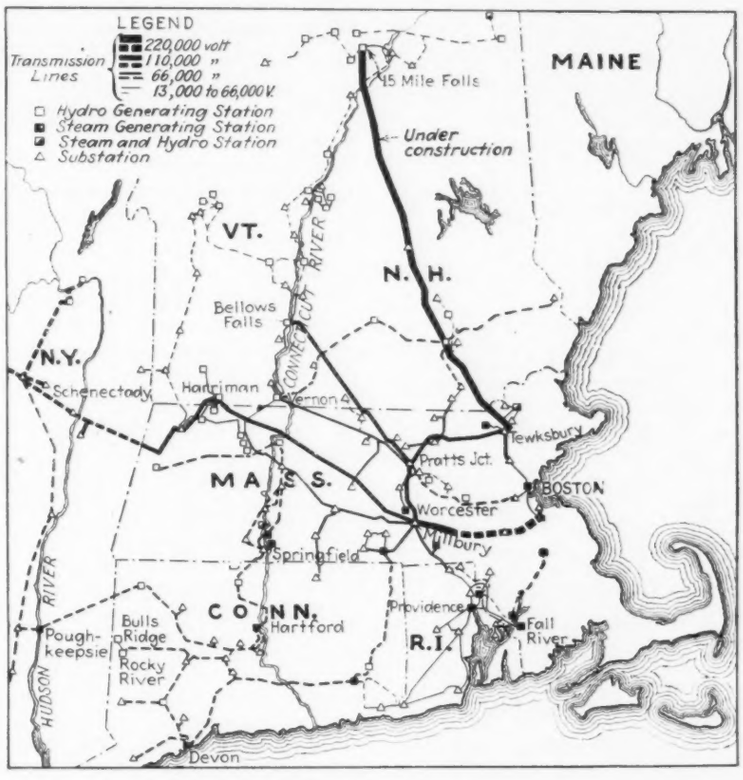
**Discussed before the New England System Operators' Club at Millbury, Mass.*

By C. P. COREY

Chief System Dispatcher
New England Power Association

Organization

patcher directs the control of load from this point. To follow the trend of the load the system dispatcher receives hourly readings from nine hydro stations, as to their production, water elevation, voltage, current and the number of machines generating and motoring. From the steam plants he receives hourly productions, the number of turbines in service and the number of boilers available. He receives the hourly sales and purchases to and from interconnected companies, as well as the sales and purchases, together with territory productions of the subsidiary companies. Rotary condenser operation is recorded hourly as well as voltage readings from various parts of the system. Gage readings and precipitation readings are entered on his log together with floodgate operation and flashboard changes. This information gives a picture of the system and enables him to detect flaws in its operation. Forecasts for the coming day are plotted and planned and are ready for the plants at about 4 p.m. daily. At this time a schedule of operation for the following 24 hours is passed to all plants. Frequency regulation is sponsored by the Millbury dispatcher, who, as explained before, controls plant loadings.



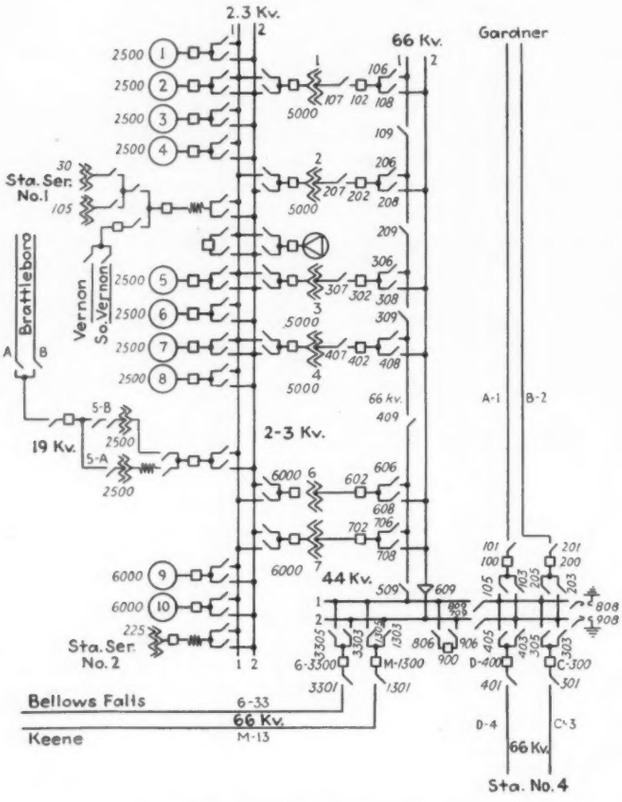
Major interconnections of New England Power Association

By 1931 the plants of the association will aggregate nearly 1,000,000 hp. in generating capacity. Thirteen lines of 110 and 66-kv. rating terminate at Millbury, Mass., the load and load dispatching center of the system, and a 220-kv. line will be in operation next fall between Fifteen Mile Falls in upper New Hampshire and Tewskbury, Mass.

The second requirement, "delegation of localized system operation to district dispatchers," allows for unlimited expansion. District offices located in Tewksbury, Providence and Worcester were organized to direct system operation in those areas, thus relieving the system dispatcher of this detail. These district offices are responsible for the switching and tagging in their areas and conduct their activities in conformance with established dispatching procedure.

The third requirement, "unified system and district dispatchers' activities," is one which contributes greatly to the success of the plan. Naturally the operation of a large system, separated as it is into divisions, requires careful consideration as to the proper delegation of authority. An organization must be so constructed as to attain a smooth, co-ordinated understanding, which in the case of dispatching is of great importance. The system dispatcher directs load designation and control and is responsible for the entire system operation. Instructions for the switching of all transmission lines originate with him, when it is consistent with the circumstances prevailing. District dispatchers direct localized system operation and co-ordinate their work to conform with system standards and requirements of the system dispatcher. On matters of district policy, the district dispatcher reports to the district chief dispatcher, who is in charge of the dispatching procedure for the district, and he in turn to the chief system dispatcher, on all matters of operation. The chief system dispatcher is responsible to the superintendent of power control, who is located at the main office of the association in Boston. This results in a unified organization in which methods are standardized and by which policies and procedures may be speedily dispatched without "red tape" or misunderstanding.

While we find it desirable to centralize the direction of all operation in various strategic centers, we realize that during times of stress no organization within practical reason could direct in detail the hundreds of movements involved in its operation without entailing undue delay. To provide for such conditions, instructions have been written governing the operation of every station of the association, in which are outlined the procedures to follow in restoring service to lines after automatic operation, or to restore service to a portion or all of the system should such a catastrophe occur, without communication with the dispatcher. Specified stations are given



Typical diagram supplied to men on tagging list

right of way, or the authority to energize lines during an interval of time, and in the event of their failure to energize such lines, other stations will assume right of way at the end of the interval and attempt to energize the lines. The dispatcher during such times attempts to establish communication with the various stations, but is assured at all times that the system will by automatic procedure restore itself to near normality. If Millbury should be isolated the system would of itself come together two minutes after shutdown. During such an emergency the station operators act as local dispachers until communication is again established with the dispatching department.

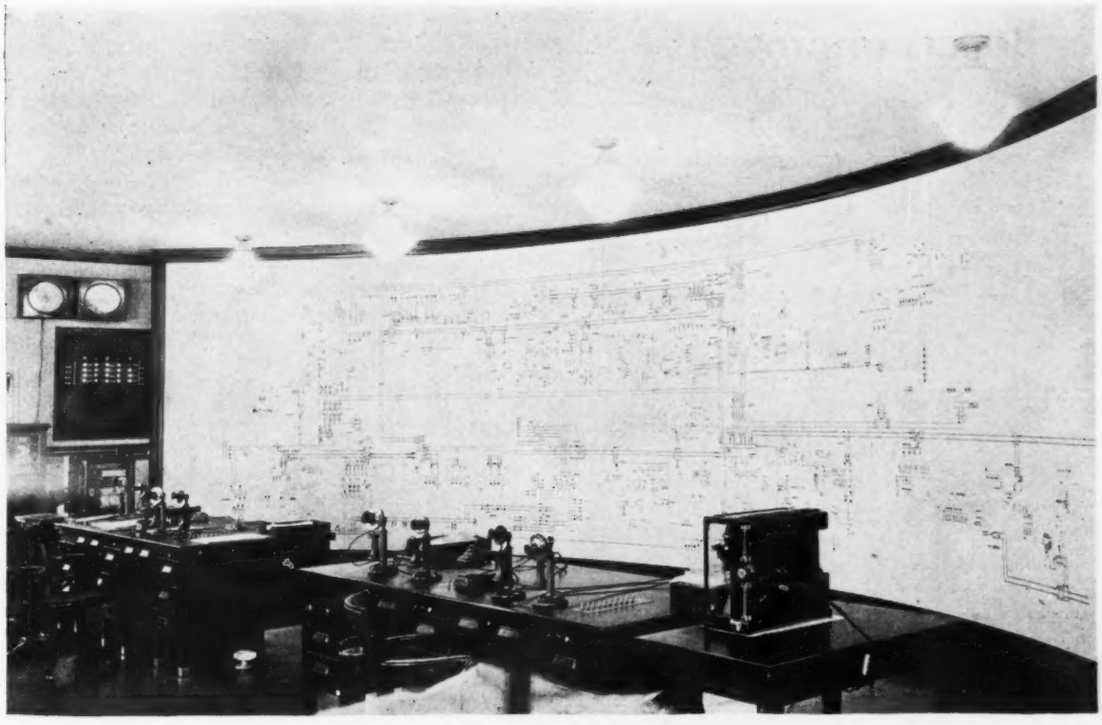
All orders issued by the dispatching department are accompanied by an official order number and all orders issued are recorded by the dispatcher on order blanks which are consecutively numbered, the particular number of the sheet on which the order is written becoming the official order number which is given to the recipient of the order. The recipient writes the official number and the order on blanks furnished for this purpose, which are consecutively numbered, and thus a complete record of the order is had. Reference to the order thereafter is by this identification number, which facilitates the speed of reporting its execution. On an average, 225 orders are issued daily relating to the switching and tagging of apparatus for the purpose of routine inspection. These orders represent only the routine part of the work and as a rule are issued during the day hours, averaging about one every two minutes. All orders require a report of execution so that the dispatching department is in contact with this work each minute of the day. For this reason it is vitally essential to follow the routine of recording such orders in order to prevent misunderstanding and increase the safety of the procedure.

"Cashing-in" on disturbances

Because of our intimate contact with the activities of the system we are in a position to observe various things which, when compiled, present records of great value. We are interested in the analysis of disurbance data from our own angle and to detect and correct errors in operation by a study of our findings. Disturbance studies have proved not only a great benefit for the dispatching department but have helped materially in influencing the design of apparatus. By a classification of the causes it is possible to reduce the number of disturbances due to them, and in some cases completely eliminate them. The operation of relays is closely observed and classified in conjunction with the relay department, defective relay operation being quickly remedied.

Disturbances in themselves are a dollars and cents proposition, both from a revenue standpoint, good will, and customer production loss. We aim not only to insure continuous service by correct design as we see it, but to observe the faults if due to design, and to correct them if it is logical to do so. Disturbance studies are carried out in a form wherein it is possible to tell the outage of any customer of our system rated as connected to our lines by 30-kva. transformers and upward. This is an important part of our work, and although the customer may not be aware of the fact, we are continually striving to improve his service. Naturally the record is a large one, containing, as it does, over 5,000 customers, all of which are posted as to the minutes interrupted with a key to the disturbance report relating to it. Disturbance studies are printed weekly and are drawn in the final form at Millbury. District offices submit weekly a résumé of their disturbances.

Disturbances are synchronized according to time, given an association number and written in a form which is clearly understood. This report outlines in detail the operation of switches, the exact time of such operation and the type of relay operating. Causes are determined and incorporated in the report as well as the features, which outline in detail the various circumstances prevailing at the time of the disturbance which might have influenced operation. These disturbance studies are printed and sent to the various department heads, who assure us that the information and analyses are of great assistance to them. All disturbance studies are made under the supervision of the assistant chief system dispatcher by men competent to analyze operations



Dispatching headquarters in Millbury

After much study a plain semi-circular board with painted lines and symbols was adopted. Changes can be made more quickly and easily than with an electrically equipped board

and suggest change in system procedure when such change will contribute to better operation.

One-line pocket diagrams

So-called pocket diagrams prove of service to our employees. It is the policy of the company to issue to every man on its tagging list a set of $4\frac{1}{8}$-in. x $6\frac{1}{8}$-in. one-line diagrams of the system connections as a means of quick reference. The dispatching department, being in a better position than any other to observe the changes being made from time to time, and to pass along to other department up-to-date drawings on our connections, is given the responsibility of keeping the diagrams correct and therefore useful. The remarkable growth of our system today, supplemented with continual refinement of the system set-up, keeps one or two men busy with this work.

To speak of the dispatchers' diagram board as the last topic in this outline seems out of order. Although some diagram boards may be larger, better and more elaborate, their presence alone will never dispatch a system. The central office as well as district offices are equipped with diagram boards, their size depending on the area served. The board at Millbury is the largest and affords a mechanical memory for the system dispatcher. Changes in system connections and status of apparatus as regards availability are recorded immediately on the diagram. Consistent with the unified requirements heretofore outlined, the diagram boards for the districts are planned in the central office and drawn under the supervision of the person normally in charge of this work at Millbury. Without the aid of a system diagram board it would be impossible for a dispatcher to remember with any degree of accuracy the details of such a vast system. Its value as an accessory to power system dispatching is incalculable, both from a safety and service standpoint.

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Auxiliaries Use 3.3 per Cent

STATISTICS regarding the amount of energy used by power plant auxiliaries are scarce, but at least three cases are known on which figures have recently appeared in the ELECTRICAL WORLD.

The Salem Electric Lighting Company, in reporting data for publication in the supplements to ELECTRICAL WORLD of May 18, 1929, and May 3, 1930, specifically indicated that the output was gross, not net, and gave the energy consumption for auxiliaries and exciters.

Location	Year	Gross Output, Kw.-Hr.	Auxiliaries and Exciters, Kw.-Hr.	Per Cent
Salem	1929	127,781,650	4,041,390	3.2
	1928	112,054,000	4,361,210	3.9
Long Beach	1928	285,733,200	9,628,320	3.4

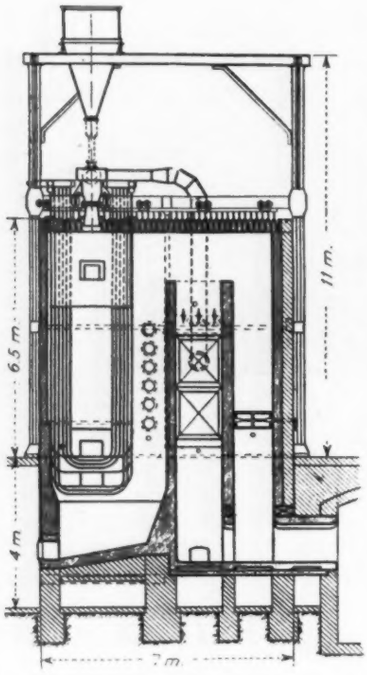
In the ELECTRICAL WORLD of May 18, 1929, on page 981, there is a report of seven months' operation of unit No. 10, Long Beach steam plant No. 3, of the Southern California Edison Company. The statement gives the energy used by auxiliaries; no mention is made of exciters, but it may be that their energy has been included.

As the accompanying tabulation shows, the auxiliaries in these three instances used between 3 and 4 per cent of the total energy generated.

Loeffler Boilers Improved

A LOEFFLER boiler for operation at 1,700-lb. pressure and a steam temperature of 932 deg. F. was installed at the Vitkovice steel works in Czechoslovakia in 1927. This boiler has been in operation for a total of 20,000 hours since that time and a combined boiler-turbine-unit operation of 3,000 hours has been had during the past year.

The success of this boiler led to the installation of two more, each with a rating of 100,000 lb. of steam per hour. One of these new boilers was placed in operation the last of June and the other was scheduled for operation early in the fall. The principle of the Loeffler boiler is to have steam pumped through a radiant superheater placed in the boiler combustion chamber. This radiant superheater consists of welded bent tubes placed in positions exposed to the powdered-coal flames. The steam is led from the radiant superheater to a second superheater, where its temperature is raised from approximately 800 deg. to 932 deg. From the second superheater the steam is divided, part going to the turbine and the larger part to evaporating drums or vaporizing drums, where steam is generated from the incoming feedwater. The new steam is pumped by a turbine-driven centrifugal pump that works only against a pressure of two or three atmospheres and is returned to the radiant superheater. The combustion chamber gases after passing the two superheaters pass through economizers and air preheaters. The exhaust from the pump turbine is used to heat the feedwater as well as additional steam bled from the stages of the main turbine.



Combustion chamber and radiant superheater or boiler for Loeffler type boiler at Vitkovice, Czechoslovakia

Burners are used with air preheated to from 600 to 780 deg. and with a low-grade fuel containing about 25 per cent ash and having a calorific value of about 9,500 B.t.u.; the flame length is only 4 to 6 ft. The bent tubes of the radiant superheater are of welded carbon-steel construction and line the sides and cross the lower part of the combustion chamber in a series of U-shaped pipes. The shape of the boiler proper can be varied at will to give a tall, broad or narrow boiler as desired. The vaporizer drums are placed below the boiler and each of the new boilers has two drums. Each is about 4 ft. in diameter and 26 ft. long.

In the early installation of only 15 tons capacity the boiler was supplied with 11,550 B.t.u. for each kilowatt-hour at the terminals and give a boiler efficiency of 85 per cent.

The entire installation, including piping, is made of carbon steel except for the second superheater, where molybdenum steel is used for mechanical reasons. No trouble has been had with valves and piping. Those in charge of the installation say it is possible to build and operate Loeffler boilers of large capacity.

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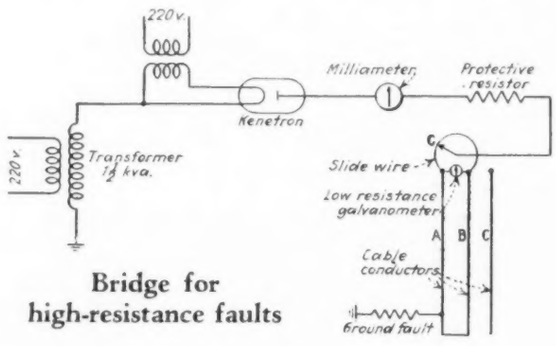
Kenetron Bridge Locates Power Cable Faults

By F. H. GOODING
Callender's Cable & Construction Company, Ltd., London

SEVERAL types of cable failures have presented considerable difficulty in identifying their character and locating them. High resistance and arcing grounds which seal when voltage is removed constitute one sort; "opens" constitute another. A new adaptation of the bridge detector has been devised by the British affiliate of the Okonite-Callender Cable Company. It has been demonstrated on the systems of several of the metropolitan companies and at association meetings. The apparatus is portable and inexpensive, composed of familiar units, and involves no intricate calculations. Faults on lengths of several miles can be located within 30 or 40 ft., sometimes as close as 10 ft.

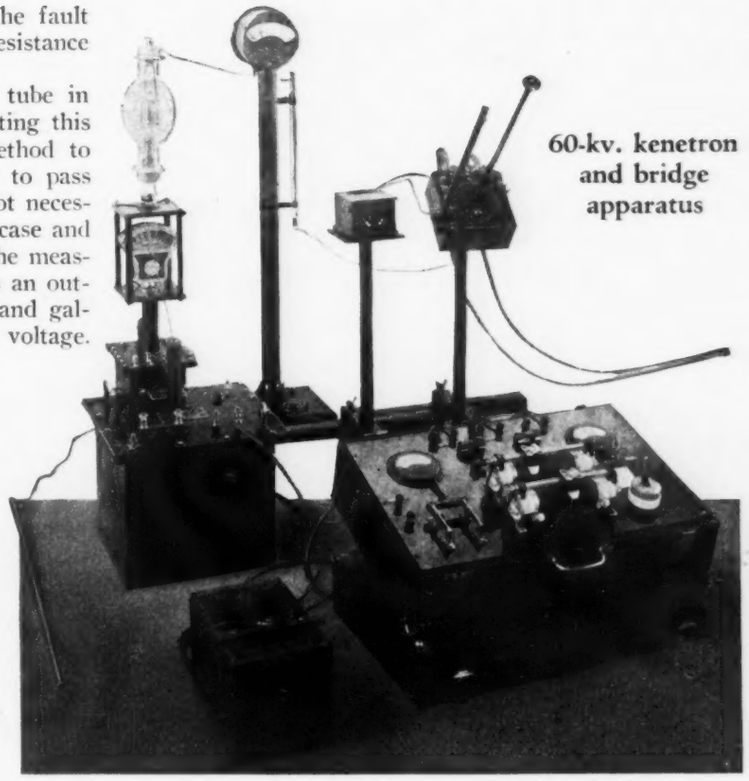
One type of apparatus has been devised for use where the conductors are continuous but show low insulation resistance. Artificial faults of such a character were created by driving a nail into the cable and withdrawing it, or a joint was opened and high resistance connected between conductors and ground, or a damp cloth wrapped around the conductors and lead sheath. It has been customary to locate such low-insulation resistances or high-resistance faults by applying a high voltage to the cable to break down the fault and then locating it by the usual bridge methods. But this method often fails because of the high voltage required and the danger of causing other faults from excessive voltage. Also, in certain



Bridge for high-resistance faults

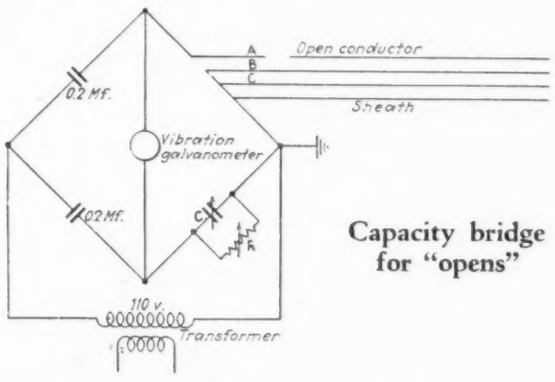
types of cable, such as oil-filled paper cables, the fault seals rapidly and it is impossible to make a low-resistance fault by burning with current.

The new method employs a small kenetron tube in conjunction with a Wheatstone bridge for locating this type of fault. It is not necessary by this method to break down the fault. It is merely necessary to pass 10 or 15 milliamperes through it. Thus it is not necessary to go to as high voltages as is usually the case and there is no danger of the fault sealing before the measurement can be obtained. The kenetron set has an output of 100 milliamperes at 60 kv.; the bridge and galvanometer are insulated from ground for this voltage. The bridge is of the slide-wire type, the wire being wound in a spiral; the rotary contact point on it is operated by means of a rod of insulating material. Connections of the set are shown in an accompanying illustration. The variable condenser *C* is adjusted until a balance or zero reading is obtained on the galvanometer. The slide-wire reading multiplied by the length in feet of the *AB* conductor loop gives the distance of the fault from the test point. Balance can be obtained with current as low as 10 milliamperes passing through the fault.



60-kv. kenetron and bridge apparatus

Artificial opens were made by removing a connector at one of the joints. Tests were also made in which the "open" wire had a low resistance to ground. This type of fault has commonly been located by means of some kind of interrupted high frequency which is picked up with an exploring coil. This at best has been uncertain, and, except in a few very favorable cases, has proved very unsatisfactory. Low-resistance opens such as those caused by burning between the ends of the conductors or a fault between conductors where both conductors are burned clear and are open can very rarely be located by the usual methods.



Capacity bridge for "opens"

For this type of fault a capacity bridge is employed. "Opens" having as low as a few hundred ohms across the open conductor have been located with a high degree of accuracy. The measurement is really made of the ground capacity of the open conductor. This is then compared with the capacity of an unbroken conductor if one is available, or, if not, with the capacity of the open wire taken from the other end of the cable.

The first step in making the location test for either type of fault consists in checking the copper resistance with a low reading "megger." The insulation resistance of each conductor is then read on the high range of the megger. These tests indicate whether to use the Wheatstone bridge or the capacity bridge in identifying the full nature of the fault and its location.

Some of the circuits tested included three different sizes of conductor and one or more branch circuits. The type of fault which seals up when voltage is taken off of course presents the most difficult problem; it was found, however, that current could be maintained through it long enough to make the test and locate the spot.

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Base-Load Steam for Hydro System

THE use of steam stations for carrying the base load on a system predominantly hydro-electric is forecast in the 1929 annual report of the Pacific Gas & Electric Company, thus:

"The heaviest load on our steam stations occurs during the dry season, when the company has normally the least amount of water for the operation of its hydro-electric plant but the greatest volume of available [natural] gas. In the winter months, when the requirements for gas for house heating and other purposes are the heaviest, the maximum amount of hydro-electric energy is available. . . . In the latter part of 1930 the installation of two new turbines, with a combined capacity of 134,000 hp., will be completed and additional units will subsequently be added to increase the total capacity of this plant to 300,000 hp. When this work is finished, the reduced cost

of steam-generated energy will undoubtedly justify the use of both our Oakland and San Francisco steam plants for base load, as well as for standby and peaking purposes."

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Curtails Use of Potential Transformer Fuses

By E. R. STAUFFACHER
Electrical Protection Engineer
Southern California Edison Company,
Los Angeles, Calif.

WHERE it is necessary to install a potential transformer directly on the 66-kv. bus at the larger substations and generating plants of the Southern California Edison Company the practice has been to protect these potential transformers, or rather protect the system against trouble in the transformer, by means of high-grade fuses. However, experience shows that fuses alone will hardly handle a short circuit of the magnitude which might occur under some conditions, and it has been found advisable to mount resistance units in series with a fuse to limit the current. In the past this was done by the use of extra-resistance tubes mounted on an extra set of insulators, resulting in a comparatively expensive job. Later this was modified by a development of one of the manufacturers in the form of a combination resistance and fuse mounting which obviated the necessity of additional stacks of insulators. Moreover, a more compact installation resulted, as well as a saving of approximately 40 per cent over the method formerly used.

During 1929, as a result of some trouble experienced with fuses breaking under normal operating conditions, it was decided to abolish the use of fuses on potential transformers connected to a circuit, either entering or leaving a station. Dependence is placed on the oil circuit breakers to clear a short circuit from the system in case of a potential transformer breakdown. On high-voltage buses which are provided with bus differential protection fuses will not be used, since relays have been provided to drop a short-circuited bus promptly from the system in case of a phase-to-phase or phase-to-ground short circuit at any point on the bus. This reduces the necessity of fuses to locations where a potential transformer must be mounted on the bus and where bus differential protection is not provided. Here fuses with suitable resistance units are provided.

A step has been made toward the elimination of potential transformers altogether at one of the company's substations. Here, in place of potential transformers on the 66-kv. bus, an experimental installation of three coupling condensers has been made, with a dummy set-up of ground-current directional relays so arranged as to indicate when they operate, but with their tripping circuits disconnected from the oil circuit breakers on the 66-kv. lines which loop through the station. These coupling condensers have the advantage of, first, a saving of about 35 per cent over the cost of equivalent potential transformers; second, less hazard of operation due to the small amount of oil used, and third, a less expensive and more compact installation as compared to the space requirements of potential transformers. Should this installation prove successful, there is no doubt but what it will be a decidedly forward step in the elimination of a comparatively undesirable piece of equipment from the high-tension bus.

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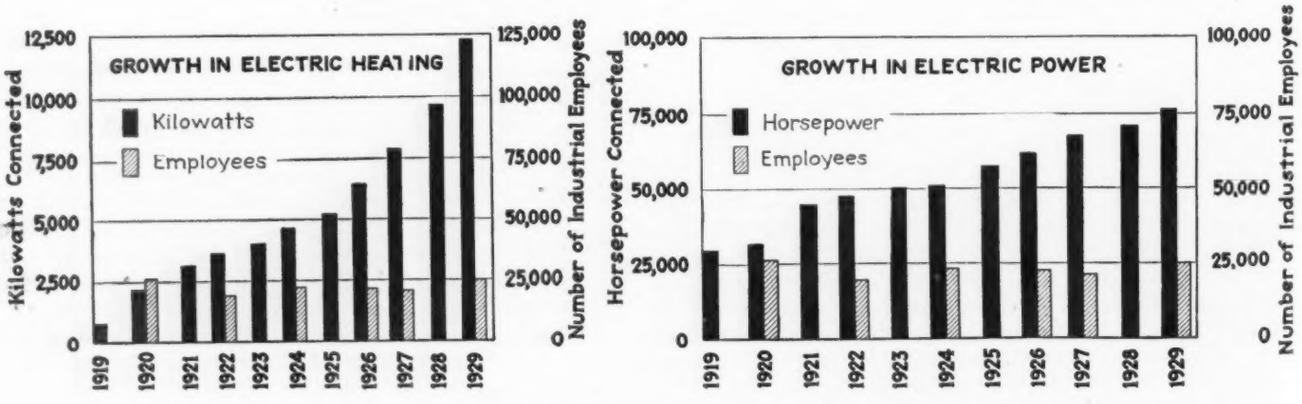
5 Kw. of Electric Heat per Worker in Hartford

EACH employee of the manufacturing industries of Hartford, Conn., has about three times as much power and sixteen times as much electric heating service at his command today as ten years ago. The sales department of the Hartford Electric Light Company has prepared the accompanying diagrams showing the growth of both classes of service in terms of total industrial employees in the territory, and it is remarkable that so little variation appears in the total personnel through the decade. The conclusion is inescapable that electricity has in large measure met the demands for increased production without forcing the manufacturers to enlarge their payroll lists anywhere nearly in proportion to the growth of business.



Industrial heating has grown at a faster rate than power since 1919, but the total volume of new power business still far exceeds the former

Germany on the Up-Grade

By L. W. W. MORROW

Editor "Electrical World"

MR. MORROW, who attended the World Power Conference at Berlin, has devoted all his time since that convention studying economic and engineering developments in several European countries with a view to ascertaining how this country can benefit by their experience and what conditions influence their future growth.

IN THE accompanying comments, just received from Germany, Mr. Morrow refers particularly to the economic conditions in that country and contrasts electrical development there with that in the United States.

GERMANY needs capital. The reparation payments and the financial maladjustments following the war wiped out the capital resources, so that industry and the people in general lack cash money. This is the dominant impression gained after a study of German business and financial conditions during a brief visit. As a result the people are rather dispirited, through the long-continued practice of the utmost economy in expenditures.

But the observer cannot fail to be more optimistic than the Germans themselves. The future is rather bright in comparison with that of other European nations. On the same basis of comparison, the national debt of Germany is $189 per capita, of France $358 per capita and of Great Britain $811 per capita. The Germans have learned how to save and how to economize, and the small margin of capital accumulations obtained each year will mount rapidly. Nor will the present money stringency be maintained when money rates for foreign capital return to normal levels expected to result from the stabilizing effect of the Young plan.

Thus, despite a present business depression and lack of capital and a resulting dispirited attitude on the part of many Germans, there is daylight ahead. The people are at work, and despite a surplus of labor and much unemployment there is no lack of food, clothing and shelter and every inch of soil and every machine is forced to produce at maximum efficiency.

A second impression of Germany is the high place given to education and physical health. The youth of the land are going to school to equip themselves for all professions, and yet equal weight is placed upon physical well-being. German boys and girls are all sun tanned and sturdy through organized national effort. They live out of doors and take exercise *en masse*.

German business appears to have enthroned the engineer and scientist. The doctors, professors and engineers are executives of business enterprises and are looked upon as the key to national prosperity by the masses. These men are getting results of a certain type. Steel ingot production was 16,245,921 metric tons in 1929, an increase of 36 per cent over the pre-war figures, and pig iron production was 12,401,000 tons, an increase of 22 per cent over the pre-war data. The production of lignite has more than doubled, coal production was 163,437,000 tons in 1929, an increase of 16 per cent over 1913. Gas sales increased from 150,000,000 cu.m. to 1,000,000,000 cu.m. In potash, chemical fertilizer, paper and pulp and electrical manufacturing similar increases have been made. German shipping is now in fourth place, with 4,092,000 tons. Textiles, building material, automobile manufacturing and luxury products, however, show no corresponding results and have made little or no progress.

Germany exported products to the value of $3,020,000,000 in 1929, against imports of $3,210,000,000, and the unfavorable balance of trade has decreased from $810,000,000 in 1927 to $190,000,000 in 1929. In 1928 Germany held first rank in the export of electrical machinery with a total of $127,000,000, as compared to $78,000,000 in 1913. Europe took 80 per cent of this and America about 12 per cent.

Measured by these facts and impressions, it appears that Germany is left with its physical assets in land, buildings, natural resources and people. It has lost its cash capital, but it has a people with great gifts for industry, education and organization. Its industry is free from underlying debts, its agriculture is probably the most efficient in the world and its people are being educated and trained in physical health. The future of Germany seems assured, for it is based on the health, the "know how" and the industry of its people.

Electrical impressions

The electrical consumption of Germany was 30,000,000,000 kw.-hr. in 1929, as compared to 20,300,000,000 in 1925. It has highly organized its electrical industry to get interconnected lines, large power stations and the most economical use of water, brown coal and bituminous coal resources. The utilities are sometimes state or city owned, sometimes half public half private enterprises and sometimes wholly private enterprises. The systems are being expanded rapidly and interconnections between utilities are used effectively. In general, these utilities are managed and operated by scientists or engineers and executive interest is concentrated on the physical structures and engineering features of the properties.

Selling as we know it in America is absent from the executive picture in most instances. One is impressed with the great unsold electrical markets of Germany. Industrial plants have their own generating source, as a rule, and every German town and valley presents a forest of smokestacks to intrigue the interest of an American utility salesman. There is little effort made to sell electricity to industries or to the homes. No organized plan is in effect to get appliance sales or an effective distribution of electrical products. Rates are high and offer little inducement for sales. Most of the transmission and distribution lines are what we call "shoestrings" and the house services No. 14 wire. German electrical executives wait for business to come to them, and in fact many of them seem uninterested, not to say insulted, when sales or commercial organization topics are mentioned. These are not matters worthy of the attention of the doctor or the engineer! Yet the German electrical market that remains unsold is enormous. The most positive impression about the electric utility industry is that American commercial organization and sales promotion methods should be added to German engineering efficiency.

In the technical features of lines and power stations the German art is very similar to that prevalent in America. Developments such as the Benson and Loeffler high-pressure boilers, the use of Ruth accumulators, the many pumped-storage hydro plants, the lignite-burning power stations—all are interesting and valuable practices for American engineers to study, but their use in America becomes a matter of dollar values, service reliability and magnitude of installation required. They work very well in small units and operate satisfactorily in large ones, but the service reliability and the economic efficiency of these projects for American practice are doubtful.

An interesting aspect of the electrical industry is the advent of American capital and some degree of American management in both the manufacturing and utility business. The General Electric Company is interested in the securities of the A.E.G., the Osram and the Siemens & Halske and the International Telephone & Telegraph Company is interested in the securities of the Standards Elektricitäts A.G., which is also partly owned by the A.E.G. And heaven knows, German telephone service could be improved—it would not be tolerated in America. American financial houses, because of recent security issues, are interested in several of the larger utilities and are helping them greatly.

This interest of American capital in electrical manufacturing and electric utilities is good business for America and will help Germany. The biggest electrical opportunities in Germany today lie in adopting effective methods for selling energy and appliances in volume to industries and to the homes and in bringing telephone service to a standard such that it can be called service.

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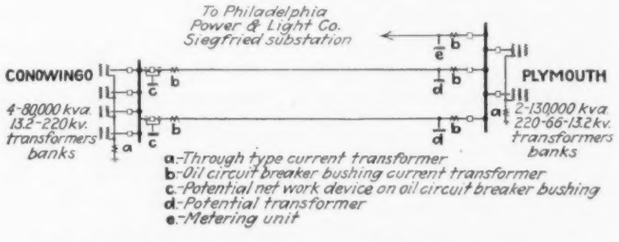
Multiple Relaying Minimizes 220-Kv. Line Outages

RELAY protection of the 60-mile, 220-kv. lines from Conowingo to Plymouth Meeting involves seven distinct functions. These provide phase-to-phase, phase-to-ground, and phase-to-ground back-up protection. There is no back-up phase-to-phase protection to the 220-kv. lines, unless the overload relays on the transformers are so considered, which, of course, clear the supply to the 220-kv. bus. However, it is expected that phase-to-phase faults will be extremely rare.

In case of a phase-to-phase fault occurring with minimum generating capacity an instantaneous undervoltage SV relay operates, allowing a directional impedance CZ relay to function; in case of fault occurring with maximum generating capacity an instantaneous overcurrent SC relay operates, allowing the impedance relay to function. Thus, heavy load currents will not cause relay


To Philadelphia Power & Light Co. Siegfried substation
CONOWINGO
PLYMOUTH
4-80000 kva. 13.2-220kv. transformers banks
2-130000 kva. 220-66-13.2kv. transformers banks
a-Through type current transformer
b-Oil circuit breaker bushing current transformer
c-Potential net work device on oil circuit breaker bushing
d-Potential transformer
e-Metering unit

Protection scheme for 220-kv. lines from Conowingo to Plymouth Meeting

Type of Protection	Number at Each Tripping Point	Relay	Operated by Instantaneous Transformers
Phase to phase	3	CZ—directional impedance relay	*b*, *c*, *d* and *e*
	3	SV—under voltage fault detector	*b*
	3	SC—overcurrent fault detector	*c*, *d* and *e*
Phase to ground	1	SC—instantaneous overcurrent ground relay	Residual of *b*
	1	CWC—instantaneous directional ground relay	*a* and residual of *b*
	1	CO—low energy ground relay	Residual of *b*
Phase to ground (back-up)	1	CWC—inverse time directional ground relay	*a* and residual of *b*

operation unless of such high value as to operate the overcurrent relay, which is set well above maximum full load.

Entirely separate from these relays are those installed for phase-to-ground protection. These consist of a plunger type instantaneous overcurrent SC relay connected in the residual circuit of the line-current transformers. This relay is made directional by connecting its contacts in series with those of an instantaneous directional CWC relay. For additional protection to instruments there is provided a low energy ground CO relay set higher in time than the SC relay and connected in the residual of a second set of line-current transformers (on the other bushings of the oil circuit breakers).

Phase-to-ground back-up protection is provided by the use of an inverse time directional CWC relay, the upper pole winding of which is connected in the residual circuit of the 220-kv. line-current transformers, while the lower pole winding is connected in series with the lower pole windings of other similar relays to a current transformer in the 220-kv. station ground.

To supplement the high-speed oil circuit breakers which are to be installed this year, the SC ground relays, which are of ordinary speed, will be replaced by Westinghouse HRC relays, which operate in 1 cycle. On the Conowingo-Plymouth lines the CWC inverse time directional relays will be replaced by Westinghouse type HD balanced ground relays operating in 1 cycle. It is probable that a scheme of transferred tripping will be superimposed on these high-speed relays, eliminating the sequential tripping which is likely to occur otherwise under some conditions.

Since the beginning of 220-kv. operation, according to the Philadelphia Electric Company, there have been sixteen operations of the relay system under normal service conditions. In all of these cases the relays caused the fault to be isolated properly. Seven of the operations occurred during the first year of operation (1928), eight were in 1929, and there has been one operation in 1930.

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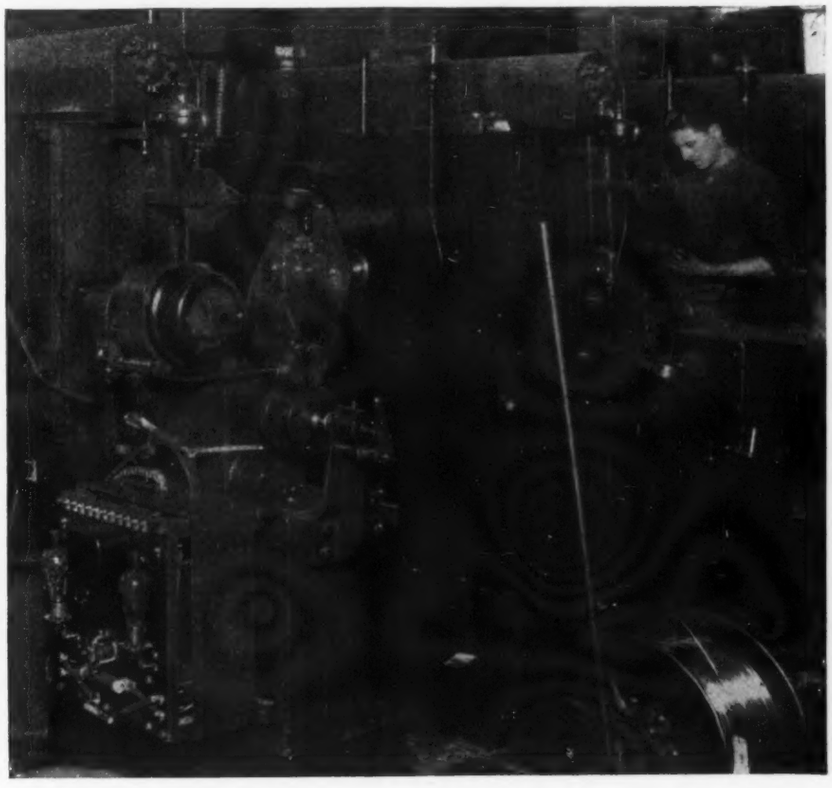
Thyratron Tubes Control Tension of Wire in Reeling

THYRATRON tubes may be used to control the tension in wire as it is being reeled after passing through drawing machines, according to the General Electric Company of Schenectady, which is using them for that purpose.

The tension in the wire is maintained by the small direct-current motor which drives the re-reel spool, and the power is supplied to this motor by thyratron tubes. A small reactor controls the output of the tubes, this control being regulated by the position of the core in the reactor; the position of the core is governed by the reeling operation itself. As the wire is reeled it runs over a rider pulley mechanically connected to the reactor core. When the re-reel motor is running too fast the loop on which the rider pulley rides decreases in length, drawing the core into the reactor. This increases the reactance and causes the tubes to pass less current, and the motor slows down. Conversely, when the loop increases in length, the reactor core is withdrawn, causing the tubes to pass more current and increase the speed of the motor.

Since the reactor coil weighs only a few ounces, very little work is done by the rider pulley, but the current controlled by the tubes may be sufficient to control the speed of a motor of several horsepower. In the installation the tubes control the current to the armature of a $\frac{3}{4}$-hp. motor with a separately excited field. However, a motor many times as large may be controlled by supplying and regulating the field current instead of the armature current.

Provision is made so that the failure of either the alternating or direct current, or the breaking of the wire, causes both the rewind motor and the motor driving the drawing machine to shut down.



Power supply to re-reel motor regulated by thyratron tubes

INADEQUATE WIRING HASTENS BUILDING OBSOLESCENCE

ILLUMINATING engineers have been encountering an increasing number of instances where owners of buildings were unable to secure desirable levels of illumination without incurring excessive expense in the reconstruction of their wiring. A few such cases have been found in new buildings. There appears to be a mistaken impression abroad that compliance with the Electrical Code or local ordinance (which have for their purpose the safety of the installation) insures adequacy for lighting purposes. It has, therefore, become apparent that there is a real need for a guide to wiring capacity, based upon modern lighting practice.

To meet this need a committee of the National Electric Light Association, which included in its personnel leading engineers, experienced in lighting and wiring, has prepared an informal set of wiring capacity paragraphs, which have been found to be reasonable and effective after a year's use in a number of localities. Based upon these paragraphs and after collaboration with other branches of the industry, as well as representative authorities, the commercial and industrial lighting committee of the association has prepared the minimum requirements herewith presented. These requirements are commended as a fair, economical and reasonable expression of the needs, within the scope indicated, which the lighting of the present and near future imposes upon the wiring. Since lighting standards are still advancing, it is probable that these requirements will need to be revised within the next few years.

Architects, engineers and builders may find it desirable to incorporate in their construction specifications part or most of the requirements set forth herein.

Minimum Specifications for Adequate Wiring of Lighting Circuits

in Commercial and Public Structures

GENERAL

The following specification defines the minimum limits of wiring installations for lighting and other applications of electricity commonly supplied from so-called "lighting" circuits that will provide adequate carrying capacity and reasonably low voltage drop. This specification applies only to installations for connection to 115-volt or 115/230-volt distribution systems and does not apply to wiring for the supply of energy to power equipment.

This specification is based upon 15-amp. fusing of branch circuits. If local regulations limit the load on branch circuits to less than 15 amp., the wattage and area limits herein specified should be proportionately reduced.

As the requirements given herein are minimum, it is recommended that the installation be increased and elaborated upon in proportion to the design, scale and appointment of the structure.

PART I—REQUIREMENTS FOR ALL COMMERCIAL AND PUBLIC STRUCTURES

1. Classification of Structures

This specification applies to the wiring installations of all buildings except structures specifically designated for occupancy as dwellings, apartments, industrial plants and structures with interiors requiring special consideration and treatment, such as theaters, large auditoriums, banking rooms, etc.

2. Convenience Outlets and Circuits Therefor

Convenience outlets shall not be placed on the same circuit with outlets used for general illumination. No more than ten convenience outlets shall be placed on one circuit (in barber shops, dentists' and doctors' offices, beauty parlors and similar places, not more than two such outlets per circuit) and those located in the wall or baseboard shall be of the duplex type. No wire smaller than No. 12 shall be used for convenience outlet circuits. Runs exceeding 100 ft. from panelboard to the first outlet should be avoided wherever practicable by relocation or addition of panelboards. Where such runs are not avoidable, no smaller than No. 10 shall be used from the panelboard to the first outlet and no wire smaller than No. 12 between outlets.

3. Ceiling Outlets for General Lighting

Whenever possible, outlets should be located on squares. In offices and school rooms no two adjacent outlets shall be spaced further apart than the distance from floor to the ceiling. In other interiors the space may be extended to 1½ times the ceiling height. In hallways and corridors maximum spacing between outlets shall not exceed 20 ft.

EXCEPTIONS TO PARAGRAPH 4

	Sq.Ft.
Auditoriums	
One circuit for each	600
Drafting rooms	
One circuit for each	200
Hospital wards or private rooms	
One circuit for each	600
Hospital operating rooms	
One circuit for each	400
Plus three additional circuits.	
Hospital laboratories and rooms for sterilization of instruments	
One circuit for each	200
School drawing and art rooms	
One circuit for each	200
School corridors and stairs	
One circuit for each	600
Garage driveways and ramps	
One circuit for each	1,000
Garage wash racks—One additional circuit from panelboard to the wash rack for special illumination.	
General lighting from other than ceiling outlets	
One circuit for each	200

4. Area for Branch Circuit for General Lighting

Except as specified below there shall be one branch circuit for the general lighting for each 400 sq.ft. or less of working space or rentable area, and one branch circuit for general lighting for each 800 sq.ft. of hallways, passageway or other non-rentable or non-producing area.

5. Wattage Per Branch Circuit for General Lighting

If the wattage of outlets is specified on the plan, branch circuits shall be so arranged that based on such specified wattage the initial load on any circuit shall not exceed 1,000 watts, except in the case of a single lamp of larger size. This is supplementary to the requirements of Sec. 4.

6. Wire Size of Branch Circuits for General Lighting

No wire smaller than No. 12 shall be used in branch circuits. For runs of over 50 ft. from the panelboard to the first outlet no wire smaller than No. 10 shall be used, and no wire smaller than No. 12 between outlets.

Runs exceeding 100 ft. from the panelboard to the first outlet shall be avoided wherever practicable by relocation or addition of panelboards. Where such runs cannot be avoided, the areas specified in Sec. 4 shall be reduced by 40 per cent and the initial load on any circuit shall not exceed 600 watts.

7. Panelboards

Panelboards shall contain a minimum of one spare circuit position for each five circuits in service or fraction thereof.

NOTE—It is recommended, but not required, that each circuit on panelboards be supplied with a switch in addition to the fuses, or with a circuit breaker, except that individual circuit switches or circuit breakers are not needed for circuits supplying show windows and signs controlled by time switches.

8. Service and Feeders

The current-carrying capacity of the service and feeders shall be great enough to supply 7½ amp. to every 15-amp. branch circuit position provided for on the panelboard or panelboards which they feed, except as permitted in the third paragraph of this section, in addition to any power requirements for heavy duty appliances or other non-lighting loads which may be supplied through this service and/or feeders.

The service and feeders shall be of such size that the total voltage drop from the service entrance to the panelboard will not exceed 2 per cent with a load equal to the total capacity as stated in the preceding paragraph.

For buildings in which the floor area exceeds 10,000 sq.ft., the standard demand factors of the 1930 National Electrical Code, Sec. 613, may be applied in determining the service and feeder carrying capacities and voltage drops. Such demand factors when used shall be applied only to the loads from the 15-amp. branch circuits computed according to the first paragraph of this section.

Conduits and ducts for inclosing service and feeders shall be of sufficient size to permit replacing the original service and feeders with wires two standard gage sizes larger or 50 per cent greater in capacity. Where conduits or ducts are not used, the original installation should have this excess capacity.

PART II—ADDITIONAL REQUIREMENTS FOR STORE AND OFFICE BUILDINGS

In the case of store and office buildings, the following requirements are additional to those defined under Part I.

9. Store Buildings—Show Windows

At least one branch circuit shall be provided for each 5 linear feet or major fraction thereof of plate glass, measured horizontally, for general illumination of the window.

At least one convenience outlet shall be provided for each 5 linear feet or major fraction thereof of plate glass, measured horizontally, for window spots or floodlights. These convenience outlets shall be on separate circuits with not more than three outlets per circuit. Such circuits shall be controlled independently of those for general illumination of the window.

In or near the floor of each window, there shall be at least one convenience outlet for each 50 sq.ft. or major fraction thereof of floor or platform area. In no case shall there be less than one for each 10 linear feet of plate glass. Not more than six such outlets shall be placed on one circuit.

10. Store Buildings—Exterior Electric Signs

A rigid metal conduit not smaller than 1 in. trade size or equivalent duct or where conduit or duct is not used, three No. 6 wires shall be run to the front face of the building, preferably from the panelboard controlling the show window. This panelboard shall have at least four branch circuit positions or equivalent for supplying an electric sign.

11. Store Buildings—Convenience Outlets

In stores having supporting columns, there shall be installed at least one convenience outlet on or in each of the supporting columns, for decorative lighting, electrically operated equipment or display fixtures.

In stores that do not have supporting columns, there shall be installed at least one floor convenience outlet for each 400 sq.ft. or major fraction thereof, of floor space, the outlets to be uniformly distributed over the entire area.

In any display areas, not more than six such outlets shall be connected to a single circuit.

12. Store Buildings—Provisions for Show Case Lighting

There shall be one circuit terminating in a pull box for each 40 linear feet or major fraction thereof of actual or probable show and/or wall case frontage.

NOTE — Where the location of show and/or wall cases has been definitely determined before the wiring is done and the original wiring layout provides capacities and facilities for show and/or wall case lighting that is equal to, or in excess of, the minimum provided above, then such wiring will be acceptable.

13. Office Buildings—Convenience Outlets

There shall be a branch circuit to supply convenience outlets for every 800 sq.ft. of floor space or major fraction thereof.

In each separate office room with 400 sq.ft. or less of floor area there shall be installed at least one convenience outlet for each 20 linear feet of wall or major fraction thereof.

In each separate office room with more than 400 sq.ft. feet of floor area there shall be installed at least four convenience outlets for the first 400 sq.ft. of floor area and at least two additional convenience outlets for each additional 400 sq.ft. or major fraction thereof.

NOTE—Outlets should be placed at suitable locations to serve all parts of the office room.

▼ ▼ ▼

Demountable Danger Sign for Line Construction

TO AVOID the cumbersome and heavy warning signs previously used in line construction, the Malden (Mass.) Electric Company has designed a metal stand weighing but 11 lb. and capable of supporting a total of 175 lb. The over-all length is but 3 ft. 6½ in., the height 3 ft. 3½ in. and the leg spread 27 in. A hook is provided on the truss for supporting a lantern, and the framing is hinged to permit folding into compact space in carrying. A duck banner of orange color, 25 x 28 in. in dimension, is attached to the truss in the field with snap buttons. Either black or green lettering is used and when the curtain becomes soiled it can easily be repainted and relettered. Ordinary stencils are used in putting on the wording. In transporting, the banner is folded around the frame and takes up but little space in a line truck.

Hinged truss provides light-weight support for danger sign

Requirements of 20 Processes That Generator-Voltage

By S. MARTIN, JR.

Industrial Engineering Department, General Electric Company

CONTROL of direct-current motor speeds and direction of rotation by varying the generator voltage and reversing its polarity has extensive industrial applications and is largely responsible for the continued and increasing favor of direct-current motors for some operations despite the almost universal supply of alternating-current service.

THIS increasing use of generator-voltage, generator-field, variable-voltage or Ward Leonard control for certain steel mill, paper mill, bridge, elevator, hoist, shovel, coal mine, cable stranding and printing operations continues despite the fact that each motor, or group of motors that maneuver as one, requires a separate motor-generator. In some cases several generators can be grouped on a common base with a single prime mover. But as a rule each motor, or group controlled as one, requires more than twice its rating in generator and driver.

SOME of the outstanding advantages of generator-voltage control are: (a) Speed adjustment covers a range from zero to the maximum motor speed; (b) motor may be almost instantly reversed without shock to correct mechanisms; (c) adjusting speed and reversing is accomplished through manipulation of field currents of very low values as compared with the armature currents of either a.-c. or d.-c. motors; (d) simplicity and effectiveness of applying regenerative braking to the motor; (e) ease with which system may be made self-protecting against overloads by means of differential series field on the generator; (f) its use, where its characteristics are suitable, results in increased outturn with lower maintenance cost than is possible with any other drive. Numerous applications of this system of voltage control have been made industrially and each has some particular variation from the elementary scheme.

Steel Mills.—Speed control and flexibility in starting and reversing large motors are paramount requirements of steel mills. These are obtained by generator-voltage control. The usual reversing mill is rated at 3,000 to 7,000 hp. continuously, the peak load on the 7,000-hp. unit sometimes reaching 22,000 hp. The usual 7,000 hp. unit for a standard 40-in. blooming mill requires 19,000 hp. peak. The normal speed range is 50 to 120 r.p.m. and fifteen reversals are required per minute. To make the rolls grip the ingot, the first few passes are made at 25 r.p.m., which imposes still more severe requirements.

Generator-voltage control solves this problem, giving extraordinary advantages. In the usual layout (Fig. 2)

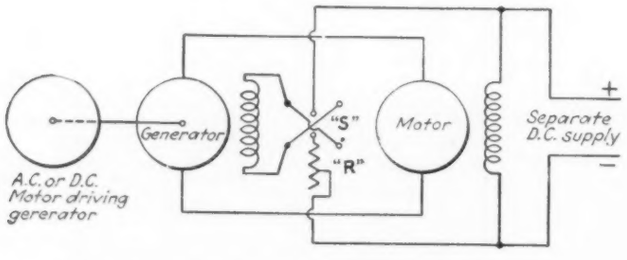


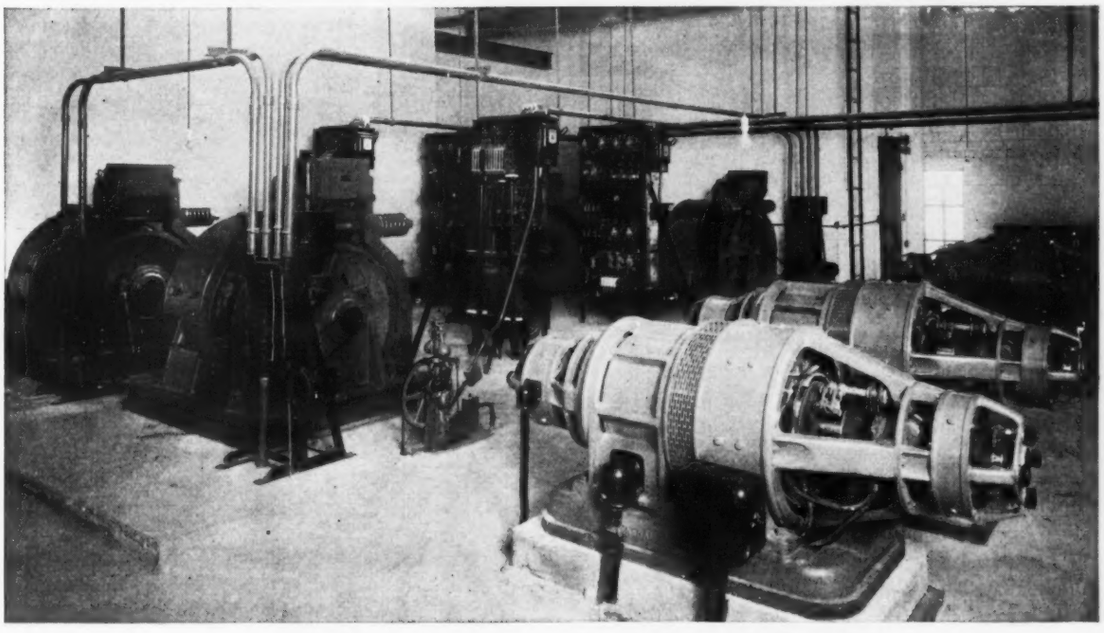
Fig. 1—Generator voltage control in its simplest form

The motor field is excited from a separate source of direct current. The field of the generator is excited in a similar manner, except that its circuit contains a reversing switch (*S*) and a field rheostat (*R*). The generator armature is electrically connected to the armature of the motor. Since the generator output may be varied from zero to maximum in either polarity the speed of the driven motor will follow the voltage and its direction of rotation will agree with the polarity. This control is accomplished through the adjustments of the relatively small generator field current. For large units the field of the generator exciter is controlled to attain this end. For example, currents of only 1 to 15 amp. are varied to control a 7,000-hp. motor.

Control Meets

cation is a second one—starting and obtaining simultaneous and proportional speed adjustments of several d.-c. motors on a continuous mill. There are several "stands" on a continuous mill, each of which has its individual motor. When one stand is speeded up or slowed down, the speed of every stand must be adjusted in proportion.

With the generator in one control scheme (Fig. 3) at normal voltage, the individual speeds are set by a rheostat on each motor. Then the control of the entire mill —either speeding up or slowing down—is obtained by generator-voltage control. By this control the relative



Gearless traction elevators in Lincoln, Neb.

for such an installation alternating current drives the motor-generator set. A flywheel on this set keeps down the peaks on the incoming power system to something between 5,000 and 6,000 hp. Small contactors control the few amperes applied to the field of the differentially compounded generator. As a result the thousands of amperes delivered to the motor are controlled and regulated without enormous contactors or circuit breakers in the motor armature circuit.

If the master switch is so placed that full field is applied to the motor and a very weak field applied to the generator, the motor turns at a very slow speed—about 25 r.p.m. If this result were attempted by other control methods, large resistance grids, dissipating an excessive amount of power, would have to be used and, even with these, the operation would be unsteady and unsatisfactory.

With a 7,000-hp. installation reversal from +50 r.p.m. to —50 r.p.m. can be made in 1.75 seconds and a reversal from +120 r.p.m. to —120 r.p.m. can be made in six seconds. In one installation a 6-amp. exciter field controls the field of the generator, which in turn controls the speed and operation of a motor that delivers 19,000 hp. at times.

Equally important with the foregoing steel mill application is a second one—starting and obtaining simultaneous and proportional speed adjustments of several d.-c. motors on a continuous mill. There are several "stands" on a continuous mill, each of which has its individual motor. When one stand is speeded up or slowed down, the speed of every stand must be adjusted in proportion.

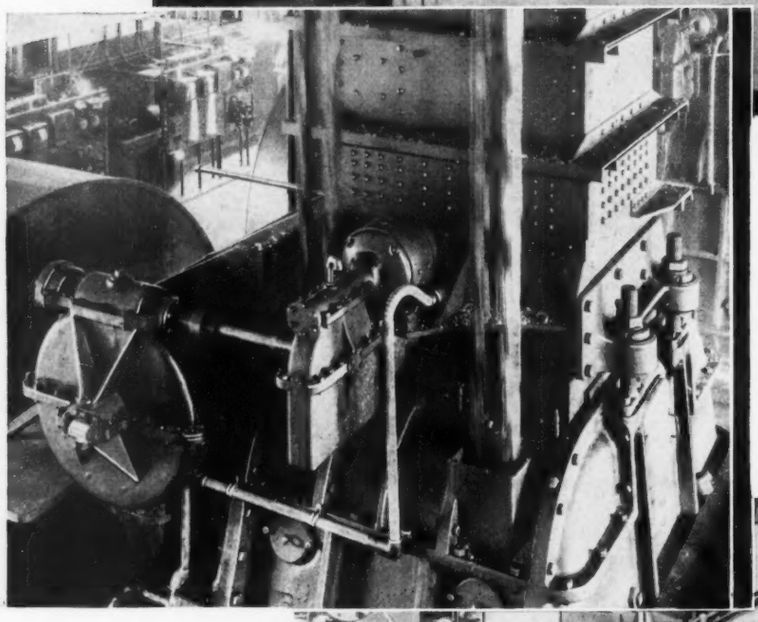
With the generator in one control scheme (Fig. 3) at normal voltage, the individual speeds are set by a rheostat on each motor. Then the control of the entire mill —either speeding up or slowing down—is obtained by generator-voltage control. By this control the relative speeds of the motors can be adjusted at a slow speed for the first ingot or rolled section until the proper conditions are obtained, and then the entire mill can be speeded up. A further advantage is the elimination of all the control for starting the individual motors.

An outstanding application of this sort is used by the Wheeling Steel Corporation of Steubenville, Ohio, on its 60-in. hot-strip mill. Three 4,000-kw. motor-generator sets, each consisting of two 2,000-kw. generators, and nine direct-current motors, ranging from 900 to 3,000 hp. and totalling 19,100 hp., are used.

Vertical Lift Bridges.—Two outstanding examples of vertical lift bridges use generator-voltage control. The first installed is at Canal, Del., over the Delaware and Chesapeake Canal. The second was placed in operation in January, 1930, and just outside Newark, N. J. Both are used by the Pennsylvania Railroad Company.

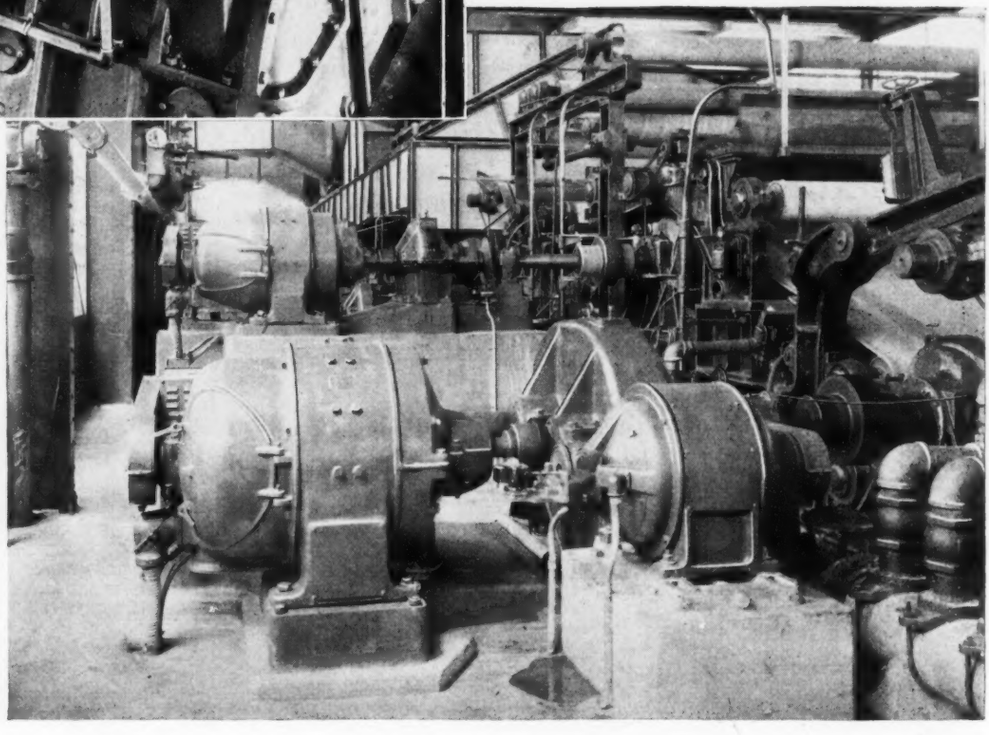
Several factors led to these installations. Electric power, while available at both sites, was very expensive. In a lift bridge emergency equipment is very often required. This means that connected load double that in use must be paid for. These conditions led to the use of gas-engine-driven d.-c. generators to operate the motors of the lift bridge. With this much determined, the

Electric lift bridge using Ward-Leonard control



Series motor driving-feed mechanism to pulp grinder through gear reduction

Motors geared to wet-end sections of paper mill



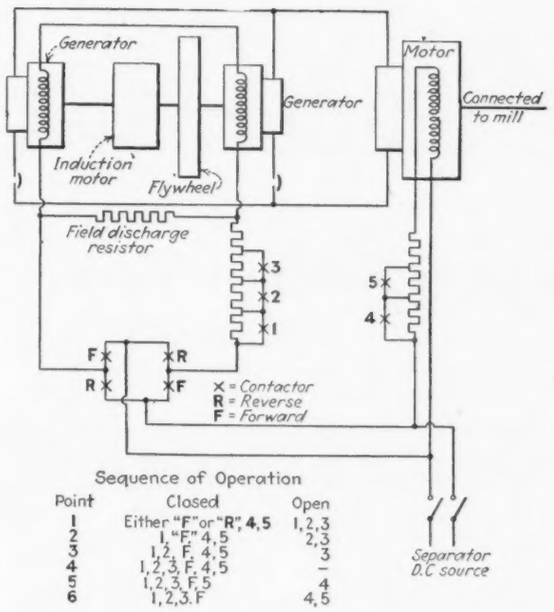


Fig. 2—Control that meets reversing mill requirements

first cost and advantages of generator-voltage control were balanced. Addition of an exciter to the gas engine set was more than offset by the elimination of resistors, contactors and other auxiliary starting equipment. On top of this, better regulation was obtained by generator-voltage control.

The differentially wound generator is equipped with a series field and two shunt fields—one self-excited and the other separately excited. This construction prevents overloading and consequent stalling of the gas engine. On each bridge are two motors which can be connected either in parallel or series. The series connection gives extremely high torque for emergency breakaway condition. Since the motors are compound wound for paralleling at the same load, reversing contactors were placed in each armature circuit. The connections of these generators are similar to those discussed later under "Shovels and Draglines."

High-Speed Elevators.—Speed control when overhauling or hoisting as well as smoothness of operation are looked for in elevator operation. Generator-voltage control is an effective solution for six reasons:

1. If the power supply is alternating current, some form of conversion must take place, as speed ranges from 45 r.p.m. up to 145 r.p.m. are not practical from a commercial frequency source.
2. Movement of the rheostat-control handle from one button to another does not provide smooth gradation of motion on rheostatically controlled motors. Smoothing out the travel by generator-voltage control is desirable for the safety and comfort of the passengers.
3. Assuming a car speed of 800 ft. per minute, the landing speed should be about 60 ft. per minute. This is a 13:1 speed range, which is very difficult to obtain by rheostatic control.
4. If automatic landing is desired, the landing speed should be about 25 ft. per minute. This requires a speed range approaching 40:1, which is impractical with rheostatic control.
5. Rheostatic control requires auxiliary control devices, such as large contactors, which wear and require more costly replacement parts than the small contactors for generator control.

For high-speed elevator control the speed-load curve (Fig. 4) of the ordinary generator-voltage control is objectionable because the curves *A-B* and *A'-B'* are not parallel to the load axis. To correct this condition the connections shown in Fig. 5 are used.

The field of the elevator motor is excited from the d.-c. bus without variation. The armature of this motor is connected in series with the field of a small booster exciter and the compound winding and armature of the generator. At slow speed the compound field on the generator tends to make the speed-low curves horizontal. Furthermore, it is of such strength that it aids in building up enough voltage in the generator to take care of voltage drop in the armature circuit for low speeds. At high speeds it is not so effective. At these speeds the small exciter used as a booster for the generator field circuit is most effective. It always takes care of a certain percentage of the armature voltage of the generator and in this way it is slightly effective at low speeds and highly effective at high speeds.

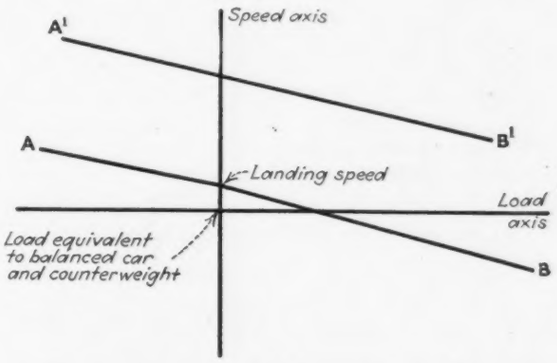


Fig. 4—Speed-load curves for ordinary generator control

There is one other important feature in the control of an elevator. This is the small motor connected in series-parallel with resistor across the field of the generator. In order to retard the building up of current in the generator field, it is connected as a shunt. A flywheel on the motor further retards the building up of the field by delaying the starting and therefore the building up of the counter-emf. of the motor. When stopping the resistor *R'* (Fig. 5) absorbs some of the energy of the motor and flywheel.

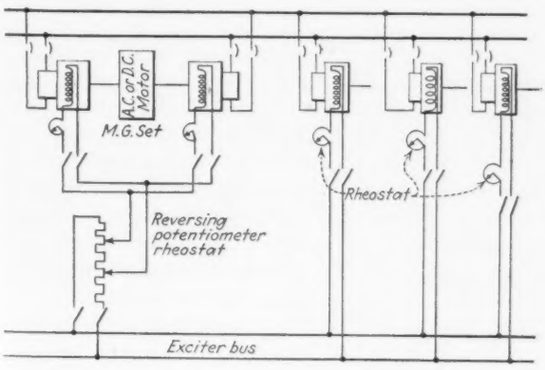


Fig. 3—Provision for maintaining relative speeds of continuous rolling mills

To get some idea of the accuracy required in stopping an elevator, and the importance of having reliable speed control of the motor, it is interesting to observe that if the landing zone is 1½ in. wide, the armature of the motor must be stopped in 1/75th of a revolution.

Freight Elevators.—Control of freight elevators is accomplished the same as high-speed elevators, the only difference being that the motor operates the elevator through a set of gears.

Paper Machines.—Paper machines are constant torque machines and may be divided into two classes, namely, single-motor drive and sectional drive. With single-motor drive one motor is mechanically connected to a multiplicity of sections and adjustment of the draw* is accomplished mechanically. On the other hand, with

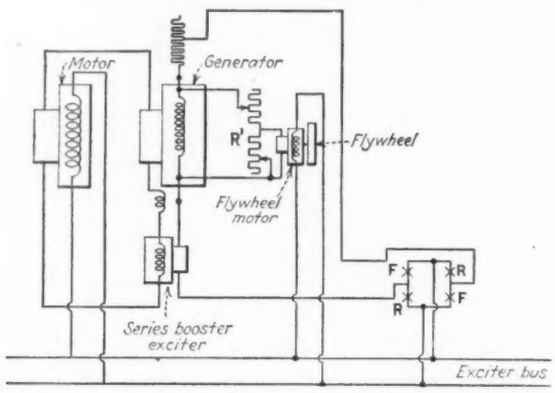


Fig. 5—Control connections for improving results with high-speed elevators

sectional drives the "draw" is provided by electrical speed regulators acting on the fields of the individual motors. In either case one generator is all that is necessary for driving normal paper machines.

For paper machines with a wide range of speeds and paper weights a generator is required for each sectional-drive motor. The main fields of the generator in this type of drive are controlled by multiple-circuit rheostats which have a common arm. A speed regulator in the auxiliary field of each individual generator adjusts the "draw." This equipment gives a range in speed and weight of paper of at least 10:1.

Pulp Grinders.—Variable-voltage generator control is used for regulating the load on the 2,400-hp. synchronous motors that drive the grindstones of magazine type pulp grinders. Variations in the hardness of the wood, amount of wood in contact with the stone, stone diameter and sharpness must be compensated for by variation in the rate of log feed. The motor driving the log-feed chain, therefore, must have a wide speed range, quickly responsive to load changes. This effect is obtained by generator-voltage control in which the generator field relay is adjusted by a contact-making wattmeter in the grinder motor power circuit.

Rewinders.—Rewinders in paper mills must have a wide speed range and constant torque as paper is wound on rolls at a constant tension, but at various speeds and under very special starting and stopping conditions. These features are discussed in other parts of this paper and will not be repeated at this time, but are merely mentioned as another application in which nicety of control and reduction in maintenance cost justify this type of drive.

The second installment of this article will be published in a later issue.

**A certain amount of stretching and squeezing of paper occurs between rolls, requiring an adjustment of the relative speeds of the sections or rolls to hold tension or "draw" between them.*

▼ ▼ ▼

Negative Factors in Vision

By M. LUCKIESH
Director Lighting Research Laboratory, Nela Park, Cleveland

IN RELATING lighting and vision for the purpose of seeing, there are helpful and opposing factors to be considered. Glare is the most obvious of the negative factors. Another is the necessity for adapting the eyes to each level of illumination or brightness over the area of the visual task. Where rapid and exacting seeing must be performed in fields of different brightnesses, the time for adaptation becomes important. The following discussion does not apply to situations where visual work is performed under a high level of illumination surrounded by darker areas in which detailed seeing is not required. It applies only when critical details must be seen alternately in brighter and darker fields.

The table gives the results of an experiment in which seeing was required alternately in two fields of different brightnesses. The speed with which the visual task was performed with a uniform illumination of 100 foot-candles was made a basis for other comparisons. Under such conditions the rate of working decreased due to (1) the lower level of illumination under which the eyes operated one-half of the time and (2) the time lost in frequent adaptation to new brightnesses.

Illumination of Work Places		Decrease in Rate of Working Due to	
Higher Level Foot-Candles	Lower Level Foot-Candles	Decrease in Illumination, (*) Per Cent	Frequent Readaptation, Per Cent
100	100	0	0
100	50	0.1	0.6
100	20	0.3	1.8
100	10	0.6	2.7
100	5	1.0	3.8
100	2	2.4	5.6
100	1	4.5	7.5

(*) These values are small since the test object was fairly visible at levels of illumination as low as 0.05 foot-candle. They would be higher if the visual task had been more difficult.

The relative time required for the frequent adaptation is given indirectly by the decrease in the rate of working. The significance of this decrease can be determined by utilizing the change in work-rate with illumination as a measuring-stick. For the severe conditions of this experiment, the "adaptation factor" is important for most brightness-ratios. The relationship of the two factors is illustrated by an example. For a uniform illumination of 2 foot-candles the rate of working is decreased 4.8 per cent, or slightly less than the adaptation effect of alternating between 100 and 2 foot-candles. At 1 foot-candle, however, the effect of decreased illumination exceeds that of "adaptation."

These conclusions, as is the case in many visual experiments, are based entirely upon the factor of visibility. Ocular discomfort, strain and fatigue are also logical and important criteria which should receive increasing attention.

Determining Justifiable Load-Building Expense

By J. R. CRAVATH

Consulting Illuminating Engineer, San Francisco, Calif.

HOW shall the value of creative load-building effort be determined? What part of gross revenue from a given device is the utility justified in spending to get the load? The author of this article says that 10 per cent of gross revenue for ten years, less interest charges and plus a pioneering factor, will give a conservative figure and cites examples to illustrate the proper method of arriving at a result for particular devices.

CREATIVE load-building activities are entirely optional with the management rather than dictated by the necessity of routine order taking. Justifiable expense for creative load building is whatever competitive conditions will permit or require. Any successful business enterprise maintains a proper balance between competition for the consumer's dollar, on the one hand, and the investor's dollar, on the other. Justifiable expenditure for securing additional business must therefore be limited to such amounts as can be added to the amounts consumers are paying for service without substantially restricting the service they will buy.

It must be assumed, of course, that these load-building expenditures are to be made in a way which will actually increase the load and that the ultimate result of such load building will work to the benefit of both consumers and investors. The possibe rate reductions that may be withheld for purposes of load building without substantially restricting the customer's use must be decided in the light of experience and judgment, in any given case. Appropriations of 2 or even 5 per cent of gross earnings for creative load building would probably look much larger to the utility company than to the consumer. The limit of expenditure for a given activity should be determined from the gross earnings of the class of business to which the activity applies rather than from the total gross earnings.

Some one will say: "This idea of spending whatever the traffic will bear on creative load building might have been all right in the old days, before we had commission regulation, but most of us are now subject to regulation, and the idea of 'what the traffic will bear' has an unpleasant association in the minds of some with the days before commission regulation, when some corporations charged considerably more than the traffic would bear and started the demand for regulation of rates. What are our commissions going to say about this?" The language may be changed if diplomacy so dictates, but the economic law that lies behind it cannot be changed. Commission and court decisions, after all, must conform to economic law. In the long run there will be no commission ban on load-building activities which are showing returns in the way of increased load, better load factors, greater economies in generation and distribution, and reduced rates. Expenditures that are not showing results naturally will be frowned upon both by commissions and competent executives.

Besides determining the over-all expense which sound economics and public policy will permit, according to the principles which have been outlined, some justifiable limit for the expense per unit of added load of any given character must be set. This is to serve as a check on unduly high expenditures per unit.

Load building is an operating expense

There are two theories as to proper accounting procedure in the treatment of business development expenses. One of these is that since such expenses are a necessary part of starting a business or of increasing it after it is started, they should be charged to capital account. When so charged, these expenses, of course, become a part of the company's permanent capital, on which a return is expected for the stockholders. For load-building expenses this theory does not seem conservative, because there is no means of knowing how permanent may be the load which is obtained from the expenditure in question.

The other theory is that creative load-building expense should be amortized over a period of years and paid out of a certain fund. This fund should be reimbursed for the expenses of the current year by yearly payments over a period of years. This comes near to the plan which is used in fact if not in form by most utility com-

panies. What is usually done is to charge operating expenses each year with the load-building expenses of that year. The new load then contributes to the gross revenues which pay operating expenses in the following years.

These theories are of interest in this discussion as enabling us to form some kind of a foundation on which to establish justifiable expense in creative load building. We will adopt the second theory, which conforms closely to practice and to sound economics. If we are to apply it to the expenses of putting any given luminaire or appliance on the lines we are confronted with the question of how much we are justified in spending on this particular appliance, and the following is offered as a sound method of answering this question.

Determining justifiable expense

Suppose a device is to be introduced that, according to the best information obtainable, will on the average add yearly 1,000 hours' use of 100 watts at a rate of 5 cents per kilowatt-hour, making an increase of $5 per year gross revenue. Considering this device to remain on the lines ten years the accrued revenue would then be $50. This figure of ten years is assumed here to illustrate the point and is a figure that has been used to some extent in this connection. It should, of course, be changed to fit whatever case is under consideration. Now if a merchant were selling $50 worth of goods, his allowance for cost of selling in common practice would range from 10 to 50 per cent of the selling price. Wishing to be conservative in this example, we will assume an allowance for the cost of selling $50 worth of energy at 10 per cent or $5. Remember, of course, that this 10 per cent applies only to the newly created business.

If $5 is spent to create this load and is to be paid back to the security holders in installments over a period of ten years, interest should be allowed on the money so tied up. We will allow 7 per cent on $2.50, the average amount, over the ten years, or $1.75.

Another factor to be considered which is highly speculative in character, but nevertheless very important, is the effect of sales made during the beginning of a campaign on sales made later. In creative load building the sales resistance is highest the first few years and should then show a decrease. If it does not decrease there is something wrong and either efforts should be discontinued or plans changed. It is proper to assume in most creative sales activities that each device put on the lines will result in one or more others of the same kind being added without creative sales expense to the company. Otherwise the activity is not a success. This does not apply to special limited applications of electricity. For this example we will assume that for every device placed on the lines by this creative sales activity another will ultimately be sold through ordinary channels. This will be called a "pioneering factor" for lack of a better name. In this case it will come to the same amount already allowed for creating the load of the first device or $5. Combining these items as shown in Table I, we arrive at the justifiable expenditure for creative load building with the device in question, with the assumed values for the different factors. Thus we find that to sell this device or service which will bring $50 additional revenue in ten years the utility is justified in spending $8.25, or 16.5 per cent of the ten-year gross revenue. Table II shows how these theories would work out for certain devices with certain assumed factors.

The object of this article has been to present principles and methods of analyzing any given problem and not in any way to supply the actual numerical factors which enter into it. Whatever figures are given are as illustrative examples. The commercial man must supply his own figures for his own particular problems.

Table I—Example Showing Theory of Estimating Justifiable Expense of a Creative Load-Building Activity for a Particular Device

1. Created gross revenue for ten years from this device; 100 watts at 5 cents per kilowatt-hour, 1,000 hours per year	$50.00
2. Ten per cent of $50 gross revenue to be devoted to creative load-building	5.00
3. $5 amortized over ten years represents an average investment of one-half of $5, or	2.50
4. Seven per cent on $2.50, average investment for ten years	1.75
5. Item (2) less (4), or the amount left for justifiable creative load-building expense before applying the "pioneering factor"	3.25
6. "Pioneering factor," an amount to be added on the assumption that each device placed on the lines by and during this particular creative load-building activity will result in the placing of at least one more on the lines without selling expense to the company; this being the same amount as item (2)	5.00
7. Justifiable expense, item (5) plus (6)	8.25

Table II—Justifiable Load-Building Expense for Specific Loads

		Factors*			
Device	Yearly Kw.-Hr.	Average Rate, Cents	Yearly Gross Revenue	Amortization Period, Years	Pioneering Factor	Justifiable Expense
Range	1,500	3	$45.00	10	$45.00	$74.25
Water heater	4,800	1.5	72.00	10	72.00	118.80
Refrigerator	600	4	24.00	10	24.00	39.70
Sunlamp	300	4	12.00	10	12.00	19.80
Kitchen luminaire	55	5	2.75	10	2.75	4.53
10 kw. of industrial heating	15,000	2.5	375.00	10	100.00	344.00

*The factors used are for example only and must be changed to fit the cases being considered.

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Blower Reduces Motor Maintenance in Cork Grinding

GRINDING stones in the cork mill of the W. & J. Sloane Manufacturing Company's linoleum plant at Trenton, N. J., are driven by 60-hp., 440-volt synchronous motors with vertical shafts, the open type motors being directly below the inclosed grinders. The ground cork, 45-60 mesh, is so fine that it permeates everything in the mill and, being an excellent heat insulator, caused burn-outs and frequent shut-downs when collecting in large quantities on the motor windings.

With the old plan one of the six machines was out of service every month; that is, one was almost continually in process of repair.

According to J. E. Richford, electrical engineer with W. & J. Sloane, the only solution offered by the manufacturer of the motors was the substitution of new motors of the totally inclosed type. To avoid this heavy expense a Buffalo turbo-blower driven by a 5-hp. induction motor was installed in the basement of the cork mill and drawing fresh air from out of doors forces it through sheet metal ducts to openings cut in the steel plate floor of the motor room, thus maintaining a steady flow of clear air to the motors.

So successful has this plan been that since its installation, three years ago, there has not been a single motor failure here. According to Mr. Richford the whole blower system cost somewhat less than $600, the motor and blower representing about $325 and the ducts and floor changes a little more than $200. The savings are tremendous, whether considered on the basis of replacing the motors with those of another type or maintaining the old ones as was formerly done.

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Electric Control Speeds Up Ditch Cleaning

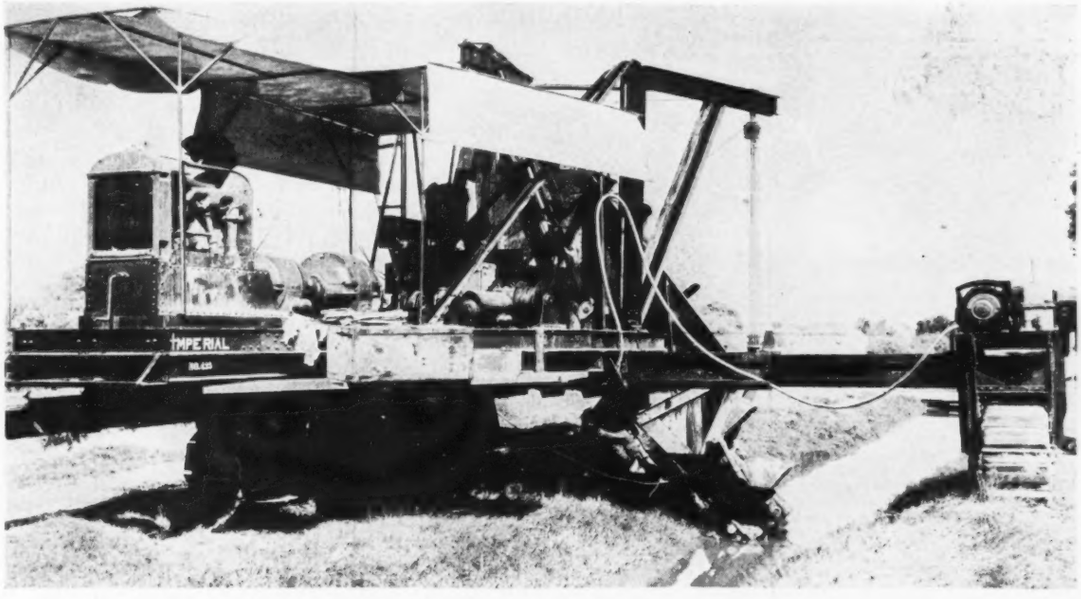
By M. M. McINTIRE
Electrical Engineer Imperial Irrigation District, Imperial, Calif.

IMPERIAL VALLEY, CALIF., with its large irrigation district taking water from the silt-laden Colorado River, is faced with a heavy annual expense for the removal of this silt from more than 3,000 miles of canals. A number of styles of bucket line de-silters have been tried out on the laterals, but due to mechanical complications it was not until the irrigation district designed and built a machine of its own that satisfactory operation was accomplished. As fast as funds are available it is planned to replace the old style mechanically driven machines, of which there are 35 in use at the present time, with the new rig, which makes use of an electrical "coupling" between the gas engine which furnishes the power and the tracks and bucket line of the de-silter.

The new de-silter is powered by a 30-hp., four-cylinder, gasoline engine which drives two direct-connected, direct-current generators. One of these is a 20-kw., 250-volt, flat-compound-wound, constant-voltage machine and the other a 10½-kw., 250-volt, variable-voltage generator with double shaft extension.

The whole machine is carried on two caterpillar tracks. Each track is powered with a 7½-hp., 295/1,750-r.p.m., 230-volt, shunt-wound motor with approximately 25 per cent speed increase above normal by means of shunt field control. Drum type controllers are provided for each motor to regulate armature current and in addition there is a rheostat in the shunt field of the small track motor. The necessity that the two tracks run at the same speed precluded the use of series motors, since the load on the outboard track motor varies constantly and the speed of a series motor would vary correspondingly, requiring a constant adjustment of controllers.

The use of shunt-wound motors provides equal track speeds, with but very little adjustment of the small track motor rheostat, and it may be readily seen that this method of control gives very close adjustment of machine speeds within quite wide limits. The field control, in addition to the others, on the small track motor al-



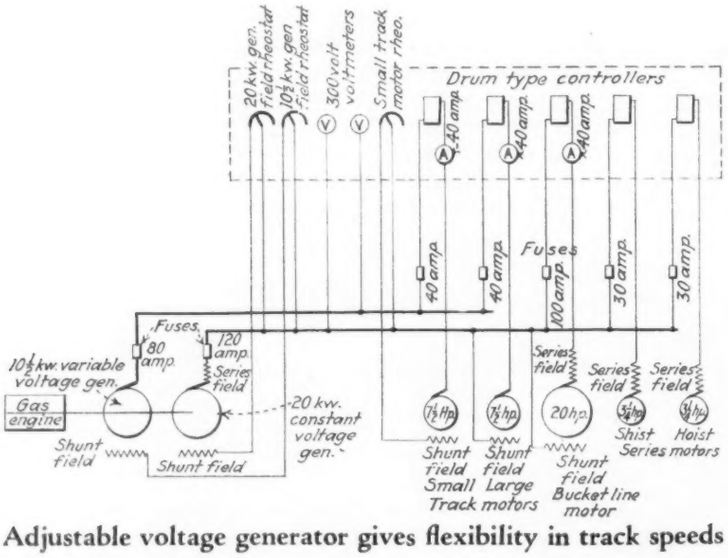
Gas-electric irrigation canal dredge which is doing three to four times the work of former mechanical equipment

lows for the variations of speed necessary to steer the machine, all steering being done by the adjustment of speed of this small track. In fact, this is the feature that necessitated the installation of such a large motor on the track where the normal load is comparatively light, but where the load imposed by the steering of the rig is sometimes considerable. Power from the two track motors is applied to the caterpillar treads through a train of gears and a chain and sprocket system. A gear shift is provided in order that the machine can make more speed on the road between jobs. The range of speeds now possible is from less than 4 ft. per minute while digging to 90 ft. per minute while traveling on the county roads between canals.

The bucket line is driven by a 20-hp., 250-volt, 1,750-r.p.m., compound-wound motor running at constant speed and controlled by a drum type controller. The speed of this motor is reduced by means of a "Tex-Rope" drive, worm reducer and chain and sprockets, all of which is mounted directly above the bucket line. The frame on which the line is mounted is shifted by means of a 3¼-hp. series motor. The same size motor is used on the hoist which handles the lower end of the bucket line.

The 20-kw. generator furnishes power for the bucket line motor, shift and hoist motors and the field currents for the track motors and, as mentioned before, the variable-voltage generator. The necessity for separately exciting the variable-voltage generator arose from the fact that during the first few months of trial the field was reversed on the generator twice, apparently due to the track motors being momentarily driven by the rig as generators, thus reversing the field of the generator. Since separately exciting this unit no further trouble of this nature has occurred.

The design as outlined in the foregoing provides a machine much more flexible and efficient than any yet employed by the district for this purpose. It will clean better than a mile of canal per ten-hour day.



Adjustable voltage generator gives flexibility in track speeds

Field of variable-voltage generator is supplied through rheostat from constant-voltage bus. Control of speed of track motors is accomplished by (1) drum controller, (2) control of generator voltage, (3) adjustment of motor fields.

The first machine built has been in constant use for more than a year, has had practically no serious shut-downs and is doing from three to four times the work of the old type machines. It is handled by one operator at the centralized controls and a swamper to move crossing timbers and haul supplies. The district's staff collaborated in the design and construction of this piece of equipment and with the exception of the castings and electrical machinery all the machine work and assembly was done in the district's shops.

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Hydro Power for Peak Loads

A HYDRO-ELECTRIC project installed and ready to go at a cost of $120 per kilowatt of installed capacity, including storage, head works, generating plant and everything. It doesn't sound reasonable. But it is, and it is true, too.

A certain utility had a river development that would deliver firm power at an investment of $220 per kilowatt. It had other hydro stations on its system as well as steam plants operating on very low cost fuel. The fuel cost and availability, if these were considered alone, would have definitely forbidden any more hydro development in the region because steam generation costs were so low as to put hydro generation out of the running. But there were other things to be taken into account. Although fuel was now cheap and abundant, there might come a time when it would not be, and also the necessity for flood control would undoubtedly put governmental agencies at work on the river if the power company did nothing with the hydro possibilities.

But while hydro power at $220 per kilowatt installed was not high, it could not compete with steam capacity at about half that amount which sent out kilowatt-hours at a very low fuel expense. However, the system was typical of this alleged electrical age which does not use half of the energy that the installed generators of the country could furnish if they were kept loaded. It had its peaks and valleys in the load curve, like all the rest. The addition of new capacity to the system was not a matter that had to be thought of in terms of firm power; it could be considered in terms of a capacity utilization factor of 50 per cent or even less. To go below 50 per cent was considered inadvisable, although it might have been perfectly safe to do so.

The new hydro development, therefore, was furnished, not with its firm power capacity, but with twice that amount. The added investment for equipment and increased plant space did not raise the total cost of the project greatly, and the final result was hydro capacity at the very low cost of $120 per kilowatt comparable to the steam capacity cost already on the system. Considering a part of the hydro power as firm and assigning to it a generation cost equal to that for steam generation permits the erection of an equation by which this system obtains peak energy at a very low figure.

Credit Marks for a Holding Company*

Frank D. Comerford
President
New England Power Association

THE policy of our company is to accept such regulation by the state authorities as may be required to protect the public interest inherent in our business.

•

To the best of my knowledge we have never had a rate case in any of our companies. We have no differences with the public that we serve or with the municipal or state authorities.

•

The New England Power Association is a legal vehicle by which 50,000 investors loan their savings to 8,700 employees and expect them to use the money so as to give a reasonable return on their investment and to do New England a service by furnishing adequate facilities for light and power. . . . I believe that I am a public servant just as are the members of your committee.

•

To my knowledge there has never been an industry located on or near our lines that has been lost to New England because of power rates.

•

This year we will spend twice as much as any other company ever spent in New England, and in two years will have expended nearly $50,000,000. In 1929 our companies paid $14,900,000 in wages.

•

The power in the Connecticut and Deerfield rivers wasted away until private initiative undertook their development. . . . Without a holding company these developments would be impossible legally, economically and financially.

•

The subsidiaries of the association paid $3,673,553 in taxes last year, or about 10 cents on every dollar taken in.

•

The isolated electric plant is today obsolete and a very great handicap to the community that it serves. The whole modern trend in the electrical industry is toward the integration of all electric facilities in a geographical area. . . . Further integration will still more improve service and lower rates to consumers. Industries prefer to locate in areas served by large power systems.

**From an address before the committee on power and light of the Massachusetts Legislature.*

One of the speakers cited Hudson as a successful municipal plant. He read the advertisement asking industries to locate there. He did not appreciate that there is not enough capacity available in Hudson to protect properly, under recognized engineering practice, the load they now have; that the chief industry of the town uses 1.5 times as much electricity as the rest of the community and that New England Power supplies this industry. If industries should locate there it will partly be due to the fact the New England Power service is available to them.

•

The price of power at the state-owned Clinton Dam was compared with the price of power for Clinton residents. The power that we buy there is not available except when the operation of the (Boston water supply) reservoir makes it available, except for 300 hours a year. . . . How long do you think a utility organization could function if it took the power from Clinton Dam and none other?

•

We shift power from New York State to Boston, from New Hampshire and Vermont to Massachusetts and Rhode Island, always taking power from the lowest cost source. . . . By this system . . . we are able to keep the power costs to the consumer low.

•

Without the holding company the Fifteen-Mile Falls development could never have been made because an adequate outlet for the power would not have been assured. . . . We are not stock jobbers, nor promoters. We have bought control of no electric company in Massachusetts to milk it.

•

It has been suggested that the Department of Public Utilities should regulate holding companies. There is no necessity for any such form of regulation. . . . A holding company, after all, is nothing more than a trustee holding the stock of various companies. True, it derives its earnings chiefly from the earnings of the subsidiaries, but if the subsidiaries themselves are regulated adequately, the public interest is protected. . . . Consider whether there is any real public demand for

changing the system of regulation that has existed here. I have found little interest in the situation throughout Massachusetts other than some concern among investors as to the safety of their investments in Bay State public utilities. I believe that on the whole the great body of the public is satisfied with its utilities and believes that there are other and more important matters requiring public attention. Has it occurred to you, as it has to me, that in all the agitation arising from the hearings of the investigating committee and those you have held practically no interest has been shown by any one except the same small group of zealous advocates?

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Virginia's Plan for Extending Rural Lines

By Prof. CHARLES E. SEITZ
Head of the Agricultural Engineering Department
Virginia Polytechnic Institute, Blacksburg, Va.

EIGHTEEN or more public utility companies, supplying more than 90 per cent of the electric energy used in Virginia, last year voluntarily adopted a standard state-wide plan for the extension of electric power lines to the farms and rural communities of the state. Under this plan the utilities will finance the construction of all rural lines except on private property and supply power at rates applying in the cities from which the extensions are built. On January 1, 1930, these electric companies reported 2,860 miles of rural lines in the state, serving over 35,000 rural customers. They expect to build at least 1,200 miles more this year to serve an additional 7,000 rural customers.

Before the state-wide plan was adopted many of the electric companies had filed with the state commission plans for rural line extensions. Few, if any, of these plans were alike. Some were very complicated and all were extremely difficult for the prospective customer to understand. To obtain electric service farmers were compelled to pay the greater part, if not the entire, cost of the electric lines extended to serve them. Then they were charged a rural rate in addition to the rate applying in the city from which the extension was made. These costs, added to the cost of wiring the farmstead, purchasing of lighting fixtures and other appliances, required in many cases a greater investment than the farmer or other rural customers could afford.

In substance, the Virginia plan, recommended by the Governor's joint committee and now in practically universal use throughout the state, is:

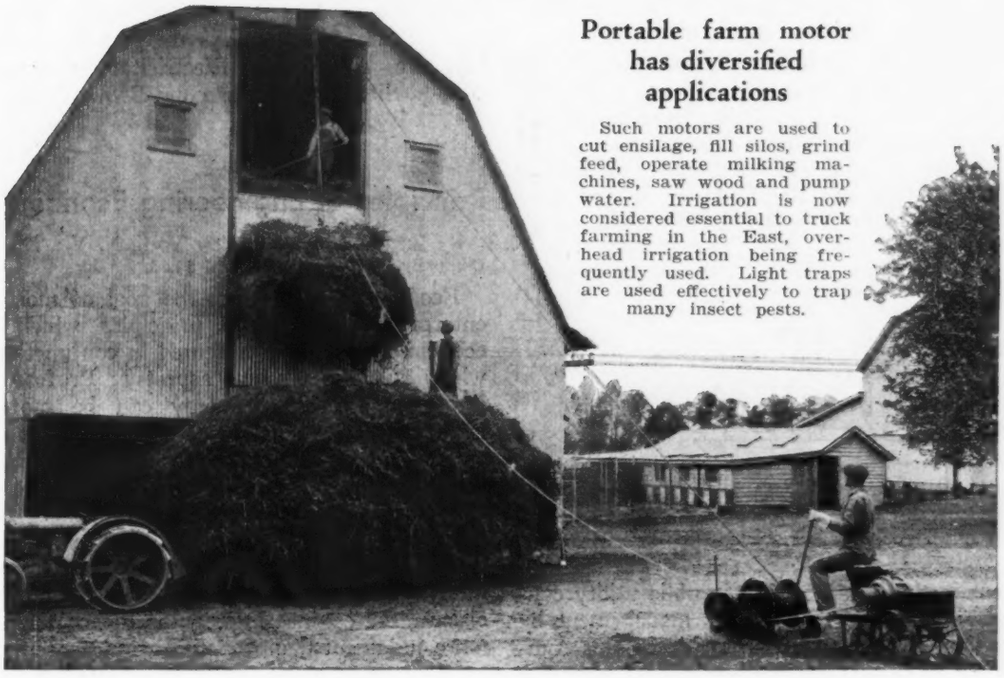
Power companies will construct, own and maintain at their expense electric line extensions along highways to serve new rural customers, provided the customers will guarantee a monthly consumption of electricity. This monthly guarantee is equal to from $1\frac{2}{3}$ to 3 per cent of the cost of the particular line constructed. When individual lines on private property are required, they are constructed, owned and maintained at the expense of the consumer. Contracts for service are made for one- to four-year periods, depending on the percentage of monthly guarantee. For example, a four-year contract usually carries a 2 per cent monthly guarantee.

The application of the state plan may be illustrated by assuming that $1,000 is the cost of constructing a certain rural line along a highway to serve five customers. Suppose the residences of four of these customers are located within 100 ft. of the highway and one is located about 1,000 ft. from the highway. The company constructs at its expense the entire line along the highway, including 100 ft. of service wires to each customer. The customer whose residence is situated 1,000 ft. from the highway constructs, at his own expense, 900 ft. of line on his private property. The monthly guarantee on the entire line extension (based on 2 per cent and a four-year contract) is $20. Since there are five customers, the monthly guarantee for each customer is $4. The customer simply guarantees to use a monthly minimum of $4 worth of energy at the some rates as charged in the nearest adjacent community.

In recommending the plan, the joint committee stressed the need for a distinct educational agency which can stand in an impartial position between the consumer and the utility to instruct and guide the farmer and to assist the utility companies in working out their problems. The

An electrified dairy farm

Among the applications on this modern farm are milking machines, separators, a refrigerating plant, bottle fillers, and sterilization machines. Many Virginia dairy farms now consume more than 2,000 kw.-hr. a month.
On poultry farms electricity is used to hatch eggs, operate brooders, warm drinking water and light poultry houses.
Poultrymen say the use of lights in the poultry houses will increase production sufficiently to pay for all electricity used on the farm.



Portable farm motor has diversified applications

Such motors are used to cut ensilage, fill silos, grind feed, operate milking machines, saw wood and pump water. Irrigation is now considered essential to truck farming in the East, overhead irrigation being frequently used. Light traps are used effectively to trap many insect pests.

agricultural engineering department of the Virginia Polytechnic Institute, with its contacts with the county agricultural agents, was regarded as the agency best suited to perform this educational function. In addition it was recommended that the power companies employ agricultural engineers to handle their rural service problems, because they can meet the farmer on his own ground.

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READERS' FORUM

Overlooks Economy of Pole Impregnation

To the Editor of the ELECTRICAL WORLD:

In an editorial in the ELECTRICAL WORLD of May 24, 1930, on the subject "Wood Construction in Favor" the value of wood as an insulating material was described, but the advantage to be gained by the use of wood was, in this editorial, offset by the statement that "wood decays," leaving the uninformed reader under the impression that there is no permanent wood-pole material.

As a matter of fact, the use of full-length pressure-creosoted pine poles has gradually increased until the number of pressure-creosoted pine poles used per year exceeds any other kind of pole.

The engineering and chemical talent of the Forest Products Laboratory, the railroads, the power companies and the telephone industry and the wood preserving industry have evolved during the past 50 years methods of production and processing of pine poles which when performed by capable and conscientious wood-preserving companies will produce pine poles that will have a life of upward of 30 years. These processes immunize the creosoted pine poles from fungus and termite attack.

Your editorial lauds wooden poles because of their insulating characteristics. Add to that desirable quality longevity, strength undiminished from any cause, and the result is approximately the perfect pole.

No doubt most of the readers of your editorial are familiar with these facts, but for the benefit of those who are not, it is requested that this correction be published.

Texas Creosoting Company,
Orange, Tex.

R. S. MANLEY,
President.

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Hydro-Steam Combinations and Price for Power

To the Editor of the ELECTRICAL WORLD:

I desire to call your attention to a misstatement that was made in the synopsis of my World Power Conference paper, published in the ELECTRICAL WORLD, June 28, 1930. On page 1344, the second paragraph from the top, reading as follows:

> Typical operations of the Conowingo plant in conjunction with the interconnected steam and hydro stations are given in Table I as illustrating the variables to be expected on a stream-flow station

is not true. Table I has no relation to Conowingo or stream-flow of the Susquehanna River, the factors being taken from a hypothetical stream and plant. The figures given in Table I are so far from the actual condition of the Susquehanna River situation that they are extremely misleading to any one who is acquainted with the river. I feel that a correction should be made in this statement so that your readers will not be misled.

I would also like to call your attention to an error in Table I, namely, that the figures for load factor have been placed after the line reading as follows: "Firm capacity in per cent of average load," whereas they

should be placed after the line reading as follows: "System load factor, per cent."

I have also read with a great deal of interest the synopsis of your paper on "Power Costs and Trends in the United States," published in the same issue. In Table III, column fuel and power, there appears to be an error in the first line as 8.6 per cent of $4,000,000,000 would be $340,000,000 and the fuel and power costs given in Table III are $34,000,000. The percentage should be 0.86.

N. E. FUNK,
Vice-President in Charge of Engineering.
Philadelphia Electric Company,

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BOOK REVIEWS

Problems in Public Utility Management

By Philip Cabot. New York: McGraw-Hill Book Company. 631 pages, illustrated. Price, $6.

Management in the broad sense of public utility control and operation, rather than purely management by holding companies, is inferred in the title of this comprehensive study of certain outstanding phases of utility operations. The case system is used to illustrate the range of problems involved in the various phases of the business. These problems were prepared under the supervision of the department of public utility management of the Graduate School of Business Administration, Harvard University, from reports of court and commission decisions, as well as from information supplied by public utilities themselves. The emphasis of the study is placed upon economic, rather than administrative or engineering, aspects of the utility industry. Marketing problems, for example, rank high, as well as the computing of rates in relation to regulation. There is also a very comprehensive chapter devoted to finance.

The book should be of value not only to students of the industry but to public utility executives and legal advisers to the companies.

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Selektive Schutzeinrichtungen für Hochspannungsanlagen Mit Anleitung zu Ihrer Projektierung

By M. Walter. Muenchen und Berlin: Verlag von R. Oldenbourg. 128 pages.

This booklet gives a good general idea about German relays for protection of high-voltage transmission lines. It begins with the explanation of the principles of design and operation of distance relays, explaining impedance, reactance and resistance relays; overcurrent, overvoltage, directional relays; their elements; their use on single-phase and three-phase lines. Further on it discusses momentary and continuous short circuits in three-phase systems and the methods of their determination, also their effects; then it presents data for the design of protective installations with impedance relays and discusses a practical example for calculation of thermal and dynamic stresses caused by short circuit in various parts of installation. Methods of protection of generators, transformers, feeders, overhead lines, cables, converters and consumer installations are discussed. Pictures of relays by Allgemeine Electricitats Gesellschaft, Paul Meyer, Siemens & Halske and Brown Boveri are shown.

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Principles of Engineering Economy

By Eugene L. Grant. New York, N. Y.: The Ronald Press Company. 380 pages. Price, $3.75.

Economical results are the goal of most engineering enterprises. Shall the principles which govern the economic aspects be presented in conjunction with those which rule the physical aspects? Professor Grant believes engineering economy can be more effectively expounded in a separate course cognate to the technical curriculum. Throughout his book the emphasis is upon the interpretation of the costs (immediate, annual and long-range) in so far as they influence the engineer's decisions. No great attempt is made to formulate universal expressions, for fear that they would give the impression merely of mathematized economics and thus obscure the engineering significance of factors involving more judgment than quantitative measurement.

The text is replete with data from a variety of engineering sources. In most instances they have been modified to serve the immediate purpose and not carry disconcerting and extraneous peculiarities out of the situation in which they arose. Problems for solution, however, give free play to the exercise of judgment as well as simple mathematics.

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Forschungshefte der Studiengesellschaft für Höchstspannungsanlagen e.V.

Edited by Professor A. Matthias. Berlin: Vereinigung der Elektrizitätswerke e.V. Volume 2, Insulating Materials, 101 pages, 130 illustrations, two color inserts.

With the increasing use of high voltages and the incentives for progressing to ever higher values than those in current practice a series of original papers on insulating materials is particularly opportune. The volume under consideration contains nine monographs dealing with various classes of insulation, embodying the results of experimental investigations conducted by competent research workers. Chemical as well as electrical behavior has been studied. The results are presented in tables and charts, and are then discussed. Designers and responsible operators of high-tension equipment should find here much information useful to them in their work.

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The Electric and Magnetic Circuits

By E. N. Pink. New York: Isaac Pitman & Sons. 122 pages. Price, $1.

From Edinburgh comes this text dealing in an elementary way with the customary circuits, both electric and magnetic, encountered in d.c. and a.c. practice. The development is effected without resort to calculus. The polyphase system is covered and there is a chapter on the circuit consequences of non-sinusoidal wave forms

Men of the Industry

R. M. Boykin in New York

R. M. BOYKIN, for many years associated with the Puget Sound Power & Light Company and affiliated companies in the Northwest, and more recently occupying the position of manager of the central district of the Puget Sound company in Seattle, has resigned his position, effective in August, to affiliate himself with the Electric Bond & Share Company, New York. It is understood that Mr. Boykin's assignment in that company will bring him in close association with Frank Silliman, Jr., a vice-president whose activities are largely centered on various properties in the states of Montana, Washington and Oregon, operating under Bond & Share management. Mr. Boykin's entry into the electrical industry followed soon after his graduation in electrical engineering from the Alabama Polytechnic Institute in 1897. He removed to Oregon in 1911 as owner and operator of the electrical property at Hillsboro, which, through a series of mergers, became a part of the Puget Sound Power & Light Company, and Mr. Boykin was named manager of the southern district with headquarters in Portland. In 1924 he was transferred to Seattle as manager of the central district. He has long been active in the American Institute of Electrical Engineers and Northwest Electric Light and Power Association circles, having been president of the latter association on two different occasions. On his recent resignation from the executive committee of that organization he was elected to honorary membership in recognition of his distinguished services.

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HOWARD H. BRISTOL has been elected president of the Bristol Company, Waterbury, Conn., succeeding his uncle, the late Prof. William H. Bristol, founder of the organization, whose death was recently announced in the ELECTRICAL WORLD.

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PAUL D. WEATHERS, treasurer of the New York Power & Light Corporation and the Mohawk Hudson Power Corporation, has resigned. JAMES MCGUIRE, formerly assistant treasurer of the New York Power & Light Corporation, has been named to succeed him in the organization and W. PAXTON LITTLE will take over the duties of treasurer of the Mohawk Hudson company.

M. L. HIBBARD, vice-president and general manager Idaho Power Company, Boise, and last year's president of the Northwest Electric Light and Power Association, was again elected president of that organization to fill the vacancy caused by the recent death of M. W. Birkett of the Washington Water Power Company, Spokane, who had been elected president for the current association year. Mr. Hibbard's election occurred at a meeting of the executive committee of the association in Portland, July 18, 1930.

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A. B. Paterson New President in New Orleans; Flowers Resigns

A. B. PATERSON, who was elected president of New Orleans Public Service, Inc., to succeed Herbert B. Flowers, resigned, as announced in the July 19 issue of the ELECTRICAL WORLD, has been connected with the company for the past ten years and is widely known in the public utility industry. He entered this field in 1905, when he became connected with the Meridian Light & Railway Company, where he remained twelve years as vice-president and general manager. It was in 1917 that he transferred his interests to New Orleans as representative of Henry L. Doherty & Company, subsequently entering the employ of Isidore Newman & Sons, pioneer developers of traction properties in New Orleans and other Southern cities. In 1920 Mr. Paterson became associated with the old New Orleans Railway & Light Company as engineer in an advisory capacity, and soon after the reorganization of the company under the name of New Orleans Public Service, Inc., was appointed general manager. Later he was also elected a vice-president and last year was made a member of the board of directors.

A. B. Paterson

Mr. Flowers, the retiring president, has also been an outstanding figure in public utility affairs. He assumed the presidency of New Orleans Public Service, Inc., in the spring of 1923, soon after the reorganization of the old New Orleans Railway & Light Company. Before assuming these executive duties in New Orleans he had been in Baltimore, where he was vice-president and general manager of the United Railway & Electric Company. Prior to his Baltimore connection he had spent seven years with the electrical and transportation departments of the Detroit United Railways. Mr. Flowers has been active in the National Electric Light Association as well as in the American Electric Railway Association.

H. B. Flowers

A. C. BLINN, formerly vice-president and general manager of the Northern Ohio Power & Light Company, has been named vice-president and general manager of the newly organized Ohio Edison Company, created by the consolidation of five Ohio utility companies. L. G. TIGHE, formerly assistant general manager of the Northern Ohio Power, has been made vice-president and director and will be in charge of the Akron division. C. S. MACCALLA, formerly vice-president and general manager of the Pennsylvania-Ohio Company, has been made vice-president and will be in charge of the Youngstown division. The other division manager of the merged company is H. E. MILLER, who will be in charge of the Springfield division. He formerly was vice-president and general manager of the Ohio Edison Company at Springfield.

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W. D. Kyser Succeeds T. H. Tutwiler in Memphis

W. D. KYSER, Memphis attorney, has been elected president of the Memphis (Tenn.) Power & Light Company and the Memphis Street Railway Company to succeed T. H. Tutwiler, resigned. Mr. Tutwiler has been president of the

W. D. Kyser

light and power company since its reorganization seven years ago and president of the railway company for 25 years. He is planning to retire from active business life.

Mr. Tutwiler's most outstanding contributions to the electrical industry were in the railway field, where he has been long recognized as an organizer and builder. A Southerner by birth—to be exact a Virginian—his first efforts were in that section of the country with the Georgia-Pacific Railway Company and the Louisville, New Orleans & Texas Railroad Company. From 1892 to 1901 he was engineer in charge of the larger part of the New Orleans Street Railway system. He then became associated with Ford, Bacon & Davis as engineer of the Birmingham Street Railway Company and was also associated with Ford, Bacon & Davis as one of the engineers in charge of converting the traction system of the two Kansas Cities from cable to electric power. In 1903 and 1904 he had charge of the rehabilitation of the Nashville Street Railway system, being also associated with Ford, Bacon & Davis in that work.

In 1905, at the invitation of the Newman interests, Mr. Tutwiler removed to Memphis as vice-president and operating general manager of the Memphis Street Railway Company, of which he became president in 1906. It was through his efforts and ability that the system was placed on such a solid basis of operation that it conspicuously withstood the harassing conditions which afflicted practically all electric traction systems following the World War. He practically rebuilt the entire system of the Memphis company. On January 1, 1923, at the termination of the receivership of the Memphis Gas & Electric Company, Mr. Tutwiler was made president of the reorganized company, known as Memphis Power & Light Company. He is a member of the American Society

T. H. Tutwiler

of Civil Engineers, Engineers Club of Memphis and Louisiana Engineering Association.

Mr. Kyser was born in Richmond, Ala., July 17, 1882. He is a practicing attorney at the Memphis bar and received his education in law at Cumberland University, Lebanon, Tenn. Mr. Kyser is president of the Memphis and Shelby County Bar Association. He began to practice law in Memphis in 1906 upon his graduation from Cumberland. He has served in many important capacities. He was assistant U. S. District Attorney for the western district of Tennessee from 1914 to 1917, when he was made United States District Attorney, which office he held until 1921.

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J. B. LEDLIE, vice-president of the Mesilla Valley Electric Company, Las Cruces, N. M., has assumed general supervision of the properties of the Western Public Service Company, located in some fifty Nebraska towns. Before his connection at Las Cruces, in 1924, Mr. Ledlie was sales manager of the El Paso Electric Company, where he spent some 3½ years. Previously he was with the Northern Texas Traction Company.

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OBITUARY

GEORGE GETTY STUART, sales manager for the Youngstown Sheet & Tube Company in the Cleveland district since 1909, died in St. Luke's Hospital, Youngstown, July 7, after a brief illness. He was 65 years of age.

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DR. ING. e.h. MAX VOGELSAND, for many years prominently identified with Voigt & Häffner A. G., Frankfurt, Germany, died July 8. He was a member of the directorate of this organization from 1906 to 1925 and after his resignation, due to illness, he continued in a consulting capacity. During his long term as chief technical director he took an important part in the development of the establishment and through his outstanding achievements earned a distinguished reputation not only among his technical colleagues but in wider circles as well.

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FERRIS H. SMOCK, who for the past year has been manager of the electric range department of the Union Electric Light & Power Company, St. Louis, Mo., died July 19 at the Baptist Sanitarium in that city of streptococcic infection. A native of Indianapolis, Mr. Smock was widely known in the electrical industry for fifteen years. In the course of his career he was for five years a lighting specialist for the General Electric Company; he was connected with the Vermont Hydro-Electric Company in public relations and welfare work; with the Eastern New Jersey Power Company at Asbury Park, N. J.; as general new-business manager with the Virginia Public Service Company, and more recently with the Associated Gas & Electric System as assistant sales manager.

Financial and Statistical News

THE markets continue to behave in normal midsummer fashion with transactions at sufficiently low levels to indicate that trading is almost purely professional. Currently issued earnings statements of the utilities covering the first half-year show but a slight reduction from the normal increase.

——EARNINGS STATEMENTS OF ELECTRICAL MANUFACTURERS, published in this issue, show the effect of depressed business for the first half-year.

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Selling Cost Under 1 per Cent

MAKING PARTNERS OF CUSTOMERS is a financing plan which has contributed in a very large way to the great expansion in the electrical industry, writes A. F. Hockenbeamer, president of the Pacific Gas & Electric Company.

Reviewing the history of customer ownership, initiated by his company sixteen years ago, Mr. Hockenbeamer says, in the current issue of *Young's Customer-Ownership Review:* "Customer ownership provided at once the necessary mechanism for placing stocks with the public and re-establishing the borrowing capacity of the utilities and has become since then an integral part of public utilities financing.

"A tabulated summary of our sales of preferred stock directly to the public in the 15½-year interval from June, 1914, to the close of 1929 shows that during this period we sold $60,753,850 par value of preferred stock at an average selling cost of 66 cents per $100 of stock sold. The cost within recent years has been less than this average. During the same period our stockholders increased from approximately 3,000 to upward of 61,000, of whom four-fifths are residents in our field of operations."

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Allis-Chalmers Profits Show Increase

THE report of the Allis-Chalmers Manufacturing Company for the first six months of 1930 shows net profit of $2,351,540, after all charges including federal taxes, equivalent to $1.87 per share on the 1,258,400 no-par common shares outstanding. This compares with a net profit of $2,179,087 for the corresponding six months of 1929, which equaled $1.73 on a similar per share basis, an increase of approximately 8 per cent.

Orders booked in the current six months aggregated $29,480,951, contrasted with $28,022,998 in the first six months a year ago, an increase of 5¼

Common Stock Sales to Customers

REVERTING to the advantages of common shares, it has always seemed to us that ultimately the customer is a better friend if he has full participation (through the medium of common stock) in the profits of the company than if the same customer had preferred shares with limited participation, and the results of our two sales, one in 1926 and one just closed, would indicate that our judgment is well founded.

J. S. NORRIS,
Vice-President and Managing Director, Montreal Light, Heat & Power Consolidated.

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CURRENT EARNINGS REPORTS OF ELECTRIC LIGHT AND POWER COMPANIES

	1930	1929	Per Cent Increase	Operating Ratio 1930	Operating Ratio 1929
Carolina Power & Light (Year ended May 31)					
Gross earnings	$9,003,973	$9,230,447	2.0	45	46
Net earnings	4,910,686	4,986,906	—2.0	..	..
Cities Service (Year ended June 30)					
Gross earnings	56,217,280	38,422,712	46.1	..	..
Net earnings	54,460,130	37,220,093	46.1	..	..
Dallas Power & Light (Year ended May 31)					
Gross earnings	5,217,443	4,947,586	5.0	47	45
Net earnings	2,776,806	2,702,366	3.0	..	..
Detroit Edison (Year ended June 30)					
Gross earnings	56,039,867	55,248,093	1.4	67	65
Net earnings	37,610,613	35,968,980	4.6	..	..
Houston Lighting & Power (Year ended May 31)					
Gross earnings	8,399,088	7,513,596	12.0	52	55
Net earnings	4,062,116	3,393,546	20.0	..	..
Louisville Gas & Electric (Year ended May 31)					
Gross earnings	10,387,064	9,963,787	4.2	..	..
Net earnings	5,411,580	5,095,530	6.2	..	..
Memphis Power & Light (Year ended May 31)					
Gross earnings	6,653,295	5,927,697	12.0	60	59
Net earnings	2,664,712	2,406,491	11.0	..	..
Northern States Power (Year ended May 31)					
Gross earnings	33,022,480	32,029,291	3.1	..	..
Net earnings	16,606,402	16,623,736	—0.1	..	..
Oklahoma Gas & Electric (Year ended May 31)					
Gross earnings	$14,599,953	$12,997,509	12.3	..	..
Net earnings	6,811,075	6,254,120	8.9	..	..
Pacific Power & Light (Year ended May 31)					
Gross earnings	4,643,569	4,785,810	—3.0	50	53
Net earnings	2,297,177	2,270,103	1.0	..	..
Pennsylvania Power & Light (Year ended May 31)					
Gross earnings	30,553,257	29,431,674	4.0	50	50
Net earnings	15,434,244	14,764,494	5.0	..	..
Philadelphia Company (Year ended May 31)					
Gross earnings	63,350,476	62,502,646	1.4	..	..
Net earnings	31,204,027	29,883,996	4.4	..	..
Public Service Corporation of New Jersey & subs. (Year ended June 30)					
Gross earnings	138,267,082	131,052,864	5.5	69	69
Net earnings*	42,397,801	39,687,789	6.8	..	..
San Diego Consolidated Gas & Electric (Year ended May 31)					
Gross earnings	7,213,446	7,301,446	—1.7	..	..
Net earnings	3,423,713	3,458,981	—1.2	..	..
Wisconsin Public Service (Year ended May 31)					
Gross earnings	5,591,041	5,226,074	6.9	..	..
Net earnings	2,418,313	2,295,662	5.3	..	..

*Operating expenses include depreciation

per cent. Unfilled orders June 30, 1930, amounted to $17,833,860, representing an increase of 38½ per cent over those at the close of 1929, when they amounted to $12,872,676.

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New Capital Issues

DURING THE WEEK ENDED July 24 the Oklahoma Gas & Electric Company made an offering of first mortgage 5 per cent gold bonds to the amount of $6,000,000, the price being 99½ and accrued interest, to yield over 5.04 per cent. These securities, dated March 1, 1925 mature March 1, 1950.

Pacific Power & Light Company issued first mortgage and prior lien gold bonds totaling $17,000,000 at 96 and accrued interest, to yield 5.29 per cent.

Offering has been made of a new issue of first mortgage 5 per cent bonds of the Mississippi Power & Light Company, a piece of financing which involved a total of $7,000,000.

New financing totaling $30,000,000 for the Texas Electric Service Company, which was recently organized as a subsidiary of the Southwestern Power & Light Company, which, in turn is controlled by the American Power & Light Company, a member of the Electric Bond & Share group, will be carried out soon.

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NEWS BRIEFS

Rights to buy additional common stock of the Midland United Company, which recently expired, resulted in 99.64 per cent of the rights being exercised. Rights were offered to stockholders to buy one additional share at $22.50 a share for each five shares held. A total of 647,021 shares will bring into the treasury $14,557,972, which will be used to finance the expansion program of subsidiaries and for other corporate purposes.

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Public Service Commission of the State of New York has granted the petition of the New York State Electric & Gas Corporation to acquire all the outstanding stock of the Eastern New York Electric & Gas Company, Inc. This proceeding is the final step in the completing of the extinction of the Eastern New York company.

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At a special general meeting shareholders of the Mexican Light & Power Company, Ltd., approved an increase of 60,000 shares in the ordinary share capital.

Forecast 25 per Cent Power Growth in Three Years

CONTINUED expansion of the electric light and power industry is indicated in a composite estimate for the next three years for a selected group of large companies. The estimate relates to companies with which the directors of the American Superpower Corporation are connected and covers about 30 per cent of the industry in the United States, measured in energy sales, with the following basic data for 1929:

Operations of Selected Companies

	Residential and Commercial	Power	Total
Energy sales, mill. kw.-hr.	4,546	17,647	22,193
Gross rev., millions	$256	$236	$492
Customers, thousands	5,177	253	5,430

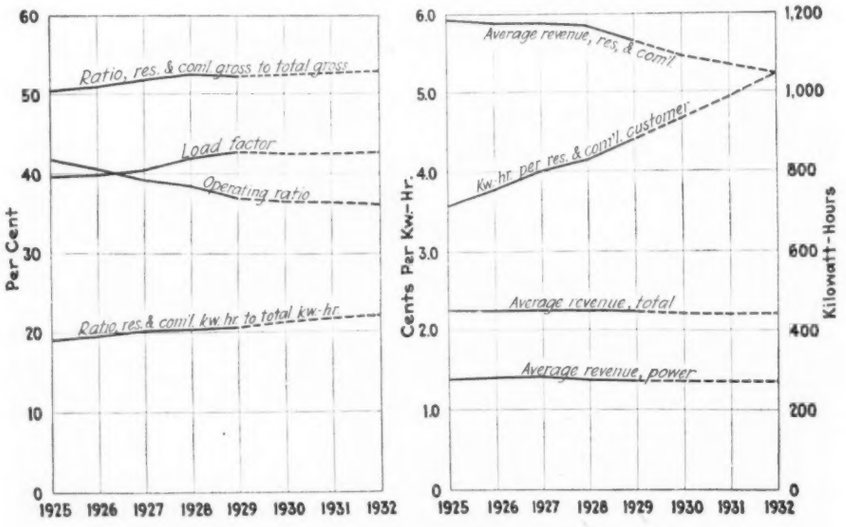
The year's consolidated gross revenue after operating expenses for the group was $310,268,962, maximum demand 5,933,401 kw. and estimated population served 27,306,701. The last named had increased 2.7 per cent over 1928.

In supplying the statistics the companies were requested to report for electric operations only, to eliminate data pertaining to sales to other public utilities and the use of electric power for railway operation and to make adjustments for changes in property so that figures for the past five years and estimates for the next three will be comparable on the basis of operations in 1929.

The results, published in connection with the award of the Bonbright Prize, indicate an expected rate of growth somewhat below that of 1925-29, larger in the domestic and commercial than in the power load, with decreasing rates per kilowatt-hour particularly in the former, an increase by 1933 to more than 1,000 kw.-hr. annually per lighting customer (residential and commercial) and a gradual improvement in the operating ratio. Details are summarized in the accompanying table of percentages and in the chart of derived statistics. Values for earlier years are included for comparison.

Per Cent Increase Over Previous Year, for Various Items

	1926	1927	1928	1929	1930	1931	1932
Residential and commercial kw.-hr	16.6	11.8	12.7	11.8	10.3	10.6	10.1
Power kw.-hr	12.7	8.0	11.6	10.3	6.6	7.1	7.4
Total kw.-hr	13.5	8.8	11.8	10.6	7.4	7.8	8.1
Residential and commercial revenue	15.8	11.7	12.2	7.8	6.7	8.1	8.1
Power revenue	13.5	8.3	8.9	9.2	5.7	7.1	7.5
Total revenue	14.7	10.2	10.6	8.5	6.2	7.7	7.8
Gross after operating expenses	17.0	12.8	14.2	8.8	6.8	8.1	8.3
Customers	10.5	5.3	9.3	5.3	3.9	5.3	4.1
Maximum demand	12.7	7.1	8.0	8.4	8.3	7.7	7.6


Ratio, res. & com'l gross to total gross
Load factor
Operating ratio
Ratio res. & com'l kw.hr. to total kw.-hr.
Per Cent
Average revenue, res. & com'l
Kw.-hr. per res. & com'l customer
Average revenue, total
Average revenue, power
Cents Per Kw.-Hr.
Kilowatt-Hours
1925 1926 1927 1928 1929 1930 1931 1932

Significant ratios show past and future operations of important group

North American Earnings Up 12.71 per Cent

AN INCREASE OF 12.71 per cent in the earnings available for common stock after all costs is shown in the earnings statement of the North American Company and subsidiaries for the year ended June 30. This is equal to $5.06 per share on the average number of common shares outstanding, as against $5.01 for the previous year. The consolidated income statement for the period is shown in the following table:

	Twelve Months Ended June 30	
	1930*	1929
Gross earnings	$147,278,310	$142,545,550
Operating expenses, maintenance and taxes	75,763,239	74,161,021
Net income from operation	$71,515,070	$68,384,529
Other net income	6,493,975†	5,260,245
Total	$78,009,046	$73,644,774
Deductions:		
Interest charges (including amortization of bond discount and expense)	19,025,303	18,633,660
Preferred dividends of subsidiaries	10,497,629	10,345,553
Minority interests	2,068,754	2,224,536
Total deductions	$31,591,686	$31,203,750
Balance for depreciation, dividends and surplus	$46,417,359	$42,441,023
Appropriations for depreciation reserves	15,916,686	15,174,259
Balance for dividends and surplus	$30,500,673	$27,266,764
Dividends on North American preferred stock	1,820,034	1,820,034
Balance for common stock dividends and surplus	$28,680,639	$25,446,730
Dividends on North American common stock	5,658,664	5,064,616
To surplus after all dividends and reserves	$23,021,975	$20,382,113
Total to depreciation reserves and to surplus after all dividends	$38,938,661	$35,556,373

*Excludes earnings of California subsidiaries from June 12, 1930, to June 30, 1930, and includes the proportion applicable to that period of actual dividends only on the common stock of Pacific Gas & Electric Company received in consideration for the North American interests in the California subsidiaries.

†Includes $1,091,707.50, representing stock dividends of non-subsidiary companies taken up at value at which stock was charged to surplus of issuing company, and $76,428.59 proceeds from sale of stock dividends.

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Energy Sales Gain 16 per Cent in Suburbs

SALES OF ELECTRIC ENERGY by the five companies composing the New York Edison System in the six months ended June 30, 1930, were 7.4 per cent larger than in the first six months of 1929, Matthew S. Sloan, president, has announced.

The total sales for the first six months of 1930 were 1,954,771,076 kw.-hr. For the same period in 1929 the figure was 1,819,428,085. The total for the entire twelve months of 1929 was 3,674,193,914 kw.-hr.

The greatest volume increase was in Brooklyn, where sales were 43,631,820 kw.-hr. greater than those for the first half of 1929, while the largest rates of increase occurred in Yonkers, 16.6 per cent, and in Queens, 16.3 per cent.

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Johns-Manville Sales Below Last Year's

NET PROFIT OF Johns-Manville Corporation and subsidiaries for the six months ended June 30 amounted to $1,740,160 after charges. This is the equivalent of $1.97 a share on common stock, against $3,039,096, or $3.70 a share, for the first half of 1929.

The consolidated income account for the six-month periods this year and last follows:

	1930	1929
Sales	$25,561,918	$29,591,640
Costs and expenses	23,603,985	26,175,383
Balance	$1,957,933	$3,416,257
Federal taxes	217,773	377,161
Net profit	$1,740,160	$3,039,096

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Westinghouse Earnings Show Decline

WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY reports for six months ended June 30, 1930, net profit of $8,357,362 after depreciation, interest and federal taxes, equivalent to $3.13 a share on 2,666,315 shares of combined preferred and common stocks. This compares with $13,131,381, or $4.92 a share on combined shares in first half of 1929.

Net profit for the quarter ended June 30 amounted to $3,810,744 after charges, compared with $4,546,618 for the preceding quarter and $7,499,681 for the same quarter of 1929.

The statement for six months ended June 30, 1930, compares as follows with that of 1929:

	1930	1929
Orders received	$95,338,159	$121,184,546
Sales billed	93,022,036	99,927,790
Profit	8,359,612	13,382,864
Interest charges	2,250	251,483
Net profit	$8,357,362	$13,131,381

The manufacture of radio receiving sets and radio tubes was transferred as of January 1, 1930, to Radio Corporation of America in exchange for an appropriate stock interest in that corporation. Orders received for products other than radio show a decrease of less than 4 per cent for the six months ended June 30, 1930, compared with the corresponding period in 1929.

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Output Continues Low

ENERGY PRODUCTION OF ELECTRIC light and power companies continues below last year's level, according to the latest weekly estimate announced by the National Electric Light Association. Compared with corresponding periods in 1929 and 1928, the kilowatt-hour production in recent weeks shows the following rates of increase:

Week Ended	—Per Cent Increase— Over 1929	Over 1928
June 21	—1.34	+11.9
June 28	—2.42	+11.9
July 5	—1.70*	+15.1
July 12	—2.52*	+ 5.0
July 19	—3.3	+ 8.8

*Adjusted for holiday.

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New York-Niagara Merger Still in Rumor Stage

NO AGREEMENT has yet been reached on the proposed interconnection of New York Edison Company and the other electrical subsidiaries of Consolidated Gas Company with Niagara Hudson Power Corporation, Matthew S. Sloan, president of the first-mentioned company, said last week. Rumor has persisted for some time that the physical merger of this group is imminent.

The latest conjecture with regard to the proposed merger is based on the fact that only a portion of the expected Niagara Hudson Power 5,000,000 share preferred stock issue will be required in the Mohawk Hudson Power Company exchange. A substantial block would be available for other purposes.

Closer relations between the companies in the Metropolitan area with Niagara Hudson Power Corporation would have evident economic advantages both in production and distribution. Such a merger would create a system with assets well over two billions and connecting the steam-generating systems of Consolidated Gas with the Niagara hydro system. According to unverified reports, engineers of the New York Edison Company and Niagara Hudson Power Corporation have completed plans for the physical interconnection of the two systems.

Business News and Markets

Electrical Manufacturing Takes Upward Turn

THE plants manufacturing electrical apparatus, equipment and supplies took an upward turn in operations during June, the increase in activity being some 1.2 per cent greater than the normal seasonal increase. The industry as a whole, which was operating during June on a plane 1.4 per cent above May, was still some 6 per cent under June last year, but was 34.8 per cent above June, 1928. Operations for the second quarter of the year averaged 1.2 per cent under the second quarter of 1929, whereas the average rate of operations during the first quarter was 10.6 per cent above the same period last year. The activity during the six-month period averaged 4.1 per cent above the same period last year. This is one of the very few industrial groups reporting operations during the first half above those of last year.

The closing month of the first half finds the smaller electrical manufacturing companies in a slightly more favorable position, comparatively speaking, than the group of larger companies, although both groups witnessed an upward turn during June. The group of smaller companies recorded a June increase of 1.8 per cent over May, but was still operating on a plane about 5.8 per cent under June last year. The group of larger companies reported June operations 0.4 per cent over May, but 6.8 per cent under June, 1929.

Indexes of Electrical Manufacturing

June, 1930	160.2
May, 1930	158.0
April, 1930	164.9
March, 1930	153.0
June, 1929	170.5
Average first half of 1930	159.6
Average first half of 1929	153.3

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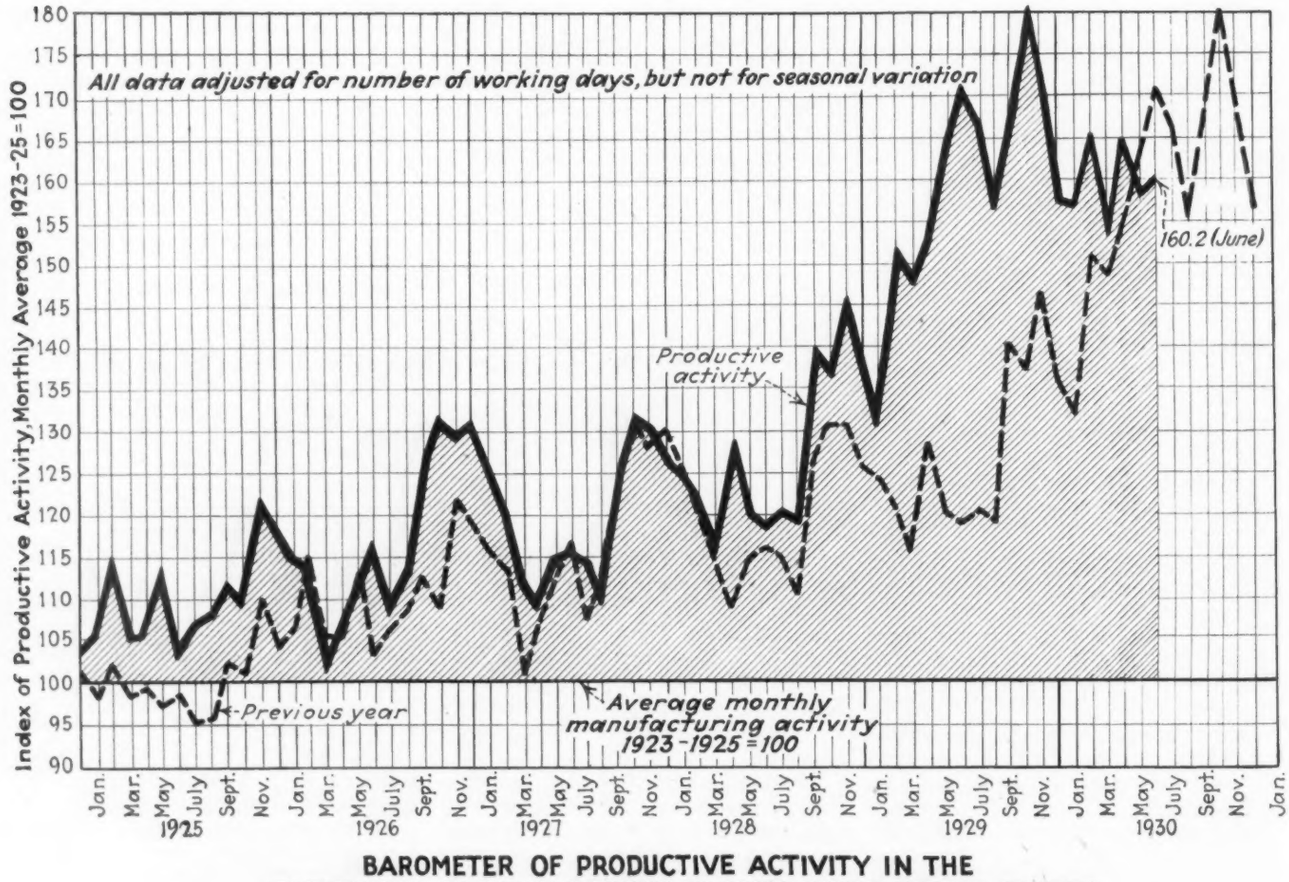
New York Metal Prices

	July 16, 1930 Cents per Pound	July 23, 1930 Cents per Pound
Copper, electrolytic	11⅛	11
Lead, Am. S. & R. price	5¼	5¼
Antimony	6¾	7
Nickel, ingot	35	35
Zinc, spots	4.55	4.75
Tin, straits	30⅛	29¾
Aluminum, 99 per cent.	23.30	23.30



BAROMETER OF PRODUCTIVE ACTIVITY IN THE ELECTRICAL MANUFACTURING PLANTS OF THE UNITED STATES

Market Conditions

ORDERS for large electrical equipment in the Eastern district are on the increase, while smaller business is diminishing. Central station, railway and marine demand is active. Equipment business on the Pacific Coast is more active this week, with power company orders in the lead.

——NEW ENGLAND REPORTS SMALL MOTOR SALES HEAVY, but large equipment business is quiet.

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PACIFIC COAST

—POWER COMPANY PURCHASES PREDOMINATE, *especially for machinery, including substation and distribution transformers, switchboards and meters. Motor purchases are slow because industrial plants are buying only for maintenance.*

—DEALERS' BUSINESS IS FAIR. *New radio business is beginning to be felt. Department stores report comparatively little reaction to their appliance demonstrations. Contracting business is better, with hopeful indications in the next few weeks.*

The week's outstanding sale covered 10,000-kva. Westinghouse transformers for Seattle territory valued at $190,000. Other sizable machinery orders included $50,000 worth of oil circuit breakers for Seattle, $15,000 worth for Portland and $40,000 worth for San Francisco, a $70,000 General Electric switchboard for station G, San Francisco and a $20,000 General Electric switchboard for Stockton.

Street-lighting business is limited to comparatively small jobs, though there are many of these, principally in northern California, such as a $6,000 award for Oakland, a $17,000 award for Fresno, a 37-standard job for Gustine, 48 standards for Sacramento and a ten-block job for Richmond in preparation for the Ford plant. The outstanding job is a $25,000 Los Angeles award. It is estimated that there are 250 outdoor miniature golf links in California, each needing a $150 electrical installation. Several hotels have been built, such as a $250,000 structure for Sonora and a $300,000 addition to the Mission Inn at Riverside. Real estate activity is increasing and bungalow and small cottage building is distinctly better. The Southern Pacific Company announces the double tracking of its main coast line from Santa Barbara north toward San Francisco, necessitating 300 rail-miles of equipment. Hospitals feature the larger construction, including a $342,000 bid for Palo Alto and a similar structure for San Mateo County.

Employment in logging camps and sawmills in Washington, Oregon and Idaho is now at lowest level since 1920 and, it is stated, approximately 50,000 lumber workers in the Pacific Northwest are either on part time or without work and there is no prospect for anything like full-time work in the industry before the early part of next year. Sales of electrical materials and motors to these sources, naturally, are at absolute minimum, buying being only for replacements. Eugene, Ore., water board awarded a contract for a 600-kw. turbo-generator unit to General Electric Company for $96,500 and for a 1,400-hp. Erie boiler to Gordon & Finbheimer of Portland for $56,896. Westinghouse, bidding $26,449, submitted best offer to board of contracts and awards, Tacoma, for furnishing eleven single-phase outdoor type and three single-phase indoor type induction feed-voltage regulators. Motor sales reported last week included 21 machines from 40 hp. down to dealers and for irrigation districts, six 20-hp. machines to a port of Portland grain elevator, ten 1-hp. motors for apple washers, ten from 30 hp. down to a fish cannery at Kamchatka and about twelve 2- and 3-hp. motors for a vegetable cannery in Puget Sound district. Several sales of small floodlighting units for miniature golf courses were reported.

CONSTRUCTION PROJECTS

Montebello, Calif., will receive bids until August 4 and Ventura, Calif., until August 5 for ornamental lighting systems. San Rafael, Redwood City, Porterville and Glendale, Calif., plan ornamental lighting systems. Great Northern Power Company, Seattle, Wash., plans hydro-electric power plant on Sultan and Skykomish Rivers, to cost over $2,000,000, with transmission system. Shelby, Mont., contemplates municipal electric light and power plant. Dillon, Mont., will soon take bids for an ornamental lighting system. Southern Colorado Power Company, Pueblo, Colo., will make extensions in power substation at Junta, Colo., and rebuild 40-mile transmission line. Salt River Valley Water Users' Association and Arizona Edison Company, Phoenix, Ariz., plan joint transmission line and three power substations to cost $450,000. Tucumcari Power & Light Company, Tucumcari, N. M., plans addition to power plant.

SOUTHWEST

—THE IMPROVEMENT NOTED *in last week's report has continued and the large manufacturers say that the demand for meters, motors and transformers in stock sizes has been considerably better in the past week*

Large power companies have placed several good-sized orders for meters and distribution transformers. One of the large mining companies has placed an order for a 2,000-kva. transformer with switching equipment to cost $12,000.

CONSTRUCTION PROJECTS

Caruthersville, Mo., plans municipal electric light and power plant and system, reported to cost $90,000. Illinois Terminal Railroad System, St. Louis, Mo., has plans for terminal warehouse to cost $15,000,000. Oklahoma Gas & Electric Company, Oklahoma City, Okla., plans power plant to cost $200,000. Pawhuska, Okla., plans extensions in municipal electric power plant. Grand Hydro-Electric Company, Tulsa, Okla., will soon take bids for a hydro-electric power plant to cost about $500,000. West Memphis Power & Water Company, West Memphis, Ark., plans power plant to cost over $90,000. Morgan City, La., has authorized bonds for $175,000, for a municipal light and power plant.

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MIDDLE WEST

—EQUIPMENT BUSINESS CONTINUES TO SHOW *slight improvement in the Middle West district although there are indications that big equipment orders are being postponed. There is a substantial volume of business in street and ornamental lighting.*

Additional equipment for and additions to several of the smaller power plants are announced this week and circuit revision work is going along at approximately the normal rate.

Lighting equipment for airports is giving rise to a substantial volume of business in several sections.

CONSTRUCTION PROJECTS

Madison, Wis., plans ornamental lighting system on State Street. Whitefish Bay, Wis., will take bids for an ornamental lighting system. Wilcox-Rich Corporation, Saginaw, Mich., has filed plans for addition to automobile equipment plant to cost $150,000. Commonwealth Edison Company, Chicago, Ill., has filed plans for an equipment storage and service plant to cost $200,000, and for a power substation on Sedgwick Street. Granite City Steel Company, Granite City, Ill., will carry out plant expansion and improvements to cost $500,000. State Line Generating Company, Hammond, Ind., has plans under way for two additional units at steam-operated electric generating plant to cost over $5,000,000. Bendix Aviation Corporation, South Bend, Ind., has filed plans for addition to aircraft and automotive equipment plant to

cost $100,000. Northern Indiana Public Service Company, Hammond, Ind., has plans for a power substation to cost $80,000. Air Corps, Chanute Field, Rantoul, Ill., will take bids until August 4 for electrical supplies. Material Division, Air Corps, Wright Field, Dayton, Ohio, will take bids until July 30 for 635 generator units (Circular 51). Minot, N. D., has authorized an ornamental lighting system. Pierre, S. D., plans addition in municipal electric light and power plant to cost $125,000. Minnesota Power & Light Company, Duluth, Minn., plans rebuilding of power plant at Cloquet, Minn. St. Charles, Minn., contemplates extensions in municipal power plant to cost about $50,000. Caniesto Cliffs Iron Mining Company, Coleraine, Minn., plans mining plant to cost $100,000. West Point, Neb., will install additional equipment in municipal light and power plant.

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NEW ENGLAND

—DURING THE PAST WEEK SALES *of heavy electrical equipment were quieter; negotiations for a number of orders for heavy mill equipment are under way, but manufacturers are of the opinion that some delay may be expected before orders are closed. Small motor sales continue to maintain a steady trend.*

Sales for this district recorded recently by one prominent manufacturer amounted to more than $33,000. Small switches and control apparatus are in fair demand and scheduled materials sold during the past month compare well with the volume reported for last year at this time, according to one prominent manufacturer. Central-station supplies are spotty. Recently substation equipment orders were placed which amounted to about $8,000; one manufacturer reports a steady demand for line materials; transformers are moving well on single orders as a rule; line materials are less active.

Some electric specialties are active and are attracting interest; street traffic signals are receiving much attention and orders received by one prominent manufacturer are far in excess of those of last year. Electric time piece sales are gaining; one group of distributors reports sales of more than 40 electric-controlled clocks in one eastern Massachusetts city last week. Merchandising is making encouraging strides in Maine and eastern Massachusetts, reports showing steady gains over last year. Electric range sales are ahead; refrigerators are active.

CONSTRUCTION PROJECTS

Strathmore Paper Company, Mittineague, Mass., contemplates plant at West Springfield, Mass., to cost $125,000. Merrimac Chemical Company, Everett, Mass., will build additions and make improvements to cost over $150,000. United Illuminating Company, New Haven, Conn., has filed plans for power substations at West Haven and Hamden, Conn. Johnson Brothers, Bristol, Conn., plan hydro-electric power plant on Fall Mountain for domestic service in that district.

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EASTERN

—SIZABLE ACCOUNT FOR ELECTRICAL EQUIPMENT *continues under a good momentum in the New York district, and, on the contrary, smaller business seems to be diminishing. In other words, the bulk of orders is coming from the larger utility and industrial interests, and the more modest buyers of apparatus are out of the market.*

—CENTRAL-STATION DEMAND *is holding up well, with an improved volume of inquiries. Both railway and marine accounts are recording substantial commitments and the outlook is favorable for continuance. Electric refrigerators are scoring some excellent sales totals, as are other larger domestic electric appliances.*

An Indiana central station has contracted with a New York manufacturer for switchgear to an amount of $35,000. A power company in central New York has purchased switchgear and accessories from a state maker, costing about $60,000. A Missouri power utility has closed with a New York manufacturer for a battery of ten 20,000 kva. transformers, with 132,000 volts for main line distribution, for a new power project. A metropolitan central station has given an order for cable to a local manufacturer, totaling $65,000.

Electric insulator business is moving at an encouraging pace both for heavy and light service. Two of the largest manufacturers in this line are running on a capacity production schedule, with one company exceeding its output at this time last year; heavy strain type units have been securing some record orders. A manufacturer of transformers in the Middle West says that business is good, with June sales higher than in the corresponding month of 1929. A leading producer of steam generator units, condensers and other power station equipment reports a healthy demand, with business for the first six months exceeding that for the same period of last year, and with unfilled orders on hand approximating $10,000,000; plants are operating to capacity.

The Salt Lake & Utah Railroad has contracted for one electric freight locomotive with the Baldwin Locomotive Works, the electric equipment to be furnished by the Westinghouse Electric & Manufacturing Company. In the line of railroad rolling stock, the Detroit Edison Company has purchased five hopper cars from the American Car & Foundry Company. The Solvay Process Company, Syracuse, N. Y., which is carrying out a $5,000,000 expansion program, will purchase some rolling stock. A New York manufacturer of heavy marine electrical equipment has secured a contract totaling $115,000 for electric propelling apparatus, motors and other electrical machinery for two new vessels to be built at the yards of the Newport News Ship Building & Dry Dock Company.

CONSTRUCTION PROJECTS

American Can Company, New York, will proceed with plant at Terre Haute, Ind., to cost $1,000,000. Signal Supply Officer, Army Base, Brooklyn, N. Y., will receive bids until August 5 for 200 ammeters, condensers, insulators, bracket mountings, etc. (Circular 4). New York Central Railroad Company, New York, has filed plans for four-story power substation to cost $110,000. Buffalo Produce Exchange, Buffalo, N. Y., plans public market with power house, cold storage and refrigerating plant, to cost over $1,000,000. Buffalo General Electric Company, Buffalo, N. Y., has plans for power substations to cost $80,000. Department of Institutions and Agencies, Trenton, N. J., will receive bids until July 29 for switchboards for institution at Hillsdale. New York Shipbuilding Company, Camden, N. J., contemplates additional shipways and shops to cost over $150,000. Rose Mills, Inc., Philadelphia, Pa., has filed plans for generator house at textile mill. Federal Cold Storage Company, Pittsburgh, Pa., has plans for cold storage and refrigerating plant to cost $2,000,000. Chemical Warfare Service, Edgewood Arsenal, Md., will receive bids until July 9 for electrical supplies (Circular 5). Department of Commerce, Washington, D. C., will receive bids until July 29 for engine-driven generator sets. Board of District Commissioners, Washington, D. C., will receive bids until August 5 for two 200-kva. transformers.

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SOUTHEAST

—THE VOLUME OF ORDERS *in the Southeast district this week is somewhat limited. There are indications that buyers are still following a conservative policy pending definite signs of an upward move in general business.*

A few sizable orders originating with power companies are reported. Some substantial extension jobs are projected and the outlook is for a very fair volume of business for the early fall.

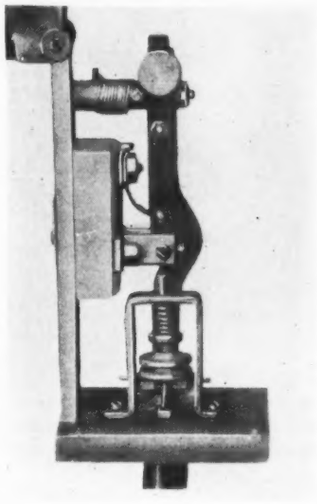
CONSTRUCTION PROJECTS

Page Power Company, Luray, Va., is projecting plans for hydro-electric power development to cost $500,000. Northern Virginia Power Company, Winchester, Va., plans transmission lines in vicinity of Charleston, W. Va. American Rolling Mill Company, Middletown, Ohio, plans expansion and improvements in steel mill at Ashland, Ky., to cost $1,000,000. Tennessee Electric Power Company, Chattanooga, Tenn., will make extensions in substations and transmission lines at Nashville, Tenn., to cost $100,000.

New Equipment Available

Quartz Rod Thermostat Accurate and Inexpensive

ACCURACY TO A HIGH DEGREE, together with low cost, is the claim for a quartz rod thermostat for controlling the temperature of soft metal melting pots



which is manufactured by the General Electric Company.

The thermostat consists of an inclosed switch with a nickel-chrome iron tube extending from its base and surrounding a steel piston and quartz rod. It has a temperature range of 450 to 950 deg. F. and will control temperatures to within plus or minus 14 deg. F. of its setting.

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Faults Located Easily by High-Tension Finder

GROUNDS OR SHORT CIRCUITS between phases in a power distribution system may be rapidly and accurately located by a high-tension faultfinder recently placed on the market by the Siemens & Halske Company, according to its American representatives, Herman H. Sticht & Company.

The high-tension measuring bridge of this instrument is designed on the principle of the Wheatstone bridge. All parts are mounted on a highly insulated molded composition panel, which is insulated from the earth by tubes of similar material, and the instrument will safely withstand tests on voltages up to approximately 50 kv. The sliding contact, which consists of a silver roller in a carriage, is fed with a high-voltage current from a rectifier. The slider can be safely adjusted by means of a grounded wheel on the end of an insulated rod. Since both the galvanometer and the slider are provided with lenses, readings can be conveniently made from a distant point. The bridge has three ranges; the faultfinder is made collapsible.

This new instrument eliminates applying high-voltage alternating current to a fault to thoroughly break it down before using the finder.

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Electrical Operator for Air-Break Switches

DIRECT ELECTRICAL OPERATION of the largest air-break switches and similar substation equipment is accomplished by a new motor mechanism announced by Hi-Voltage Equipment Company, Cleveland, Ohio.

All shafts in this mechanism are carried in ball bearings and the worm gear is inclosed in an oil-tight casing. Any degree of rotation of the main shaft between 70 and 120 deg. may be obtained by moving the crosshead in the driving crank. All adjustments are easily obtained.

The indicating light and interlocking circuits are controlled from the main shaft, so that these circuits are completed in the same manner whether the switch be operated electrically or manually. A magnetic brake brings the mechanism to a stop.

The apparatus mounts on the side of the columns of the structure and occupies little room.

Relative Humidity Recorded Directly

DIRECT AND CONTINUOUS RECORDING of relative humidity is accomplished by a device recently placed on the market by the Leeds & Northrup Company, Philadelphia. The complete equipment for recording and measuring the relative humidity consists of two separate electrical units, a wet and dry bulb apparatus and a recorder.

The wet and dry bulb apparatus consists of two similar electrical resistance thermometers mounted in a tunnel through which a stream of air under test is drawn by a small exhaust fan. One thermometer is kept wet by a wick extending into a tank of water.

A standard Leeds & Northrup recorder for use with the resistance thermometer has a special combination circuit for recording relative humidity directly, within the limits of 20 and 100 per cent and a temperature range of 0 to 80 deg. C. Within this range the recorder is sensitive to a change of about 0.5 per cent relative humidity. The limit of error is within 1.5 per cent. The recorder draws a continuous curve on a chart 10 in. wide.

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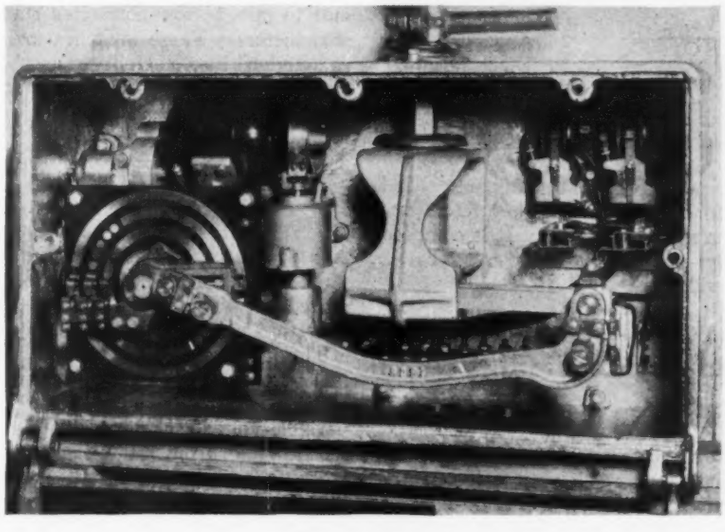
FIXTURES FOR WIRING SHOW WINDOWS which, according to the manufacturer, are inexpensive, neat and easily installed have recently been placed on the market by the Wiremold Company, Hartford, Conn. The new show window lighting outfit is installed and



assembled in the usual way from Wiremold material. It is designed to accommodate all standard make reflectors, such as "Holophane," "X-ray," "Permaflector Nevins," and others.

Cracking Device Makes Substitute for Hydrogen

AN INDUSTRIAL GAS, CALLED "ELECTROLENE," which, it is claimed, is better than hydrogen in many applications, can now be produced by feeding steam and gas or other hydrocarbons into an electric cracking device developed by the General Electric Company.

This device occupies only a small amount of space, varying according to the amount of gas required. The heat necessary for the cracking process is generated by electricity. A typical installation for producing 1,500 cu.ft. per hour would be in the form of a cylindrical shell 7 ft. in diameter and about 10 ft. high.

Electrolene can be produced at about one-tenth the cost of hydrogen, according to the manufacturer. It is especially valuable for use in electric furnaces with controllable atmospheres, in

heat-treating work, brazing, etc. It is said to burn with a higher flame temperature than hydrogen. It is composed largely of hydrogen and carbon monoxide.

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Push-Button Starting Switch Protects Small Motors

FOR CONVENIENT STARTING and stopping of small d.c. and polyphase a.c. motors a new two-pole, push-button-operated starting switch with thermal overload relays is offered by Cutler-Hammer, Inc., Milwaukee, Wis.

This starting switch can be used with d.c. motors up to ½ hp., 115 volts and ¼ hp., 230 volts or with a.c. motors—single, two or three phase up to 2 hp., 110 to 550 volts. Small in size, the inclosing case is a standard wiring box. The switch can be mounted right on the machine, at the operator's finger tips. For machinery builders, an open type switch for building directly into the machine is offered.

The thermal overload relays allow working the motor to the limit, yet disconnect it as soon as an overload becomes dangerous to the motor.

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Motor Operates Safely in Explosive Vapors

VAPOR-PROOF CONSTRUCTION, which will permit safe operation in explosive vapors, is the claim for a new type of motor announced by the Master Electric Company, Dayton, Ohio. This machine carries the label of the National Board of Fire Underwriters.

The design of the Master motor incorporates high starting torque, high overload capacity, cool running, quiet operation, vertical or horizontal mounting, large over-size bearings and interchangeable mounting dimensions, according to the manufacturer.

One-third to one-eighth horsepower sizes are available in this machine, and it is possible to get them custom built.

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IMPROVED METER SERVICE SWITCHES having blades of double-break construction and visible contacts are announced by the Trumbull Electric Manufacturing Company. Other improvements incorporated in the design of this line of switches are line connections that go straight through the box, side-hinge covers, and shutters which contain twist outs to take bottom-connected standardized meters. These switches are listed as standard by the Underwriters' Laboratories, according to the manufacturer.

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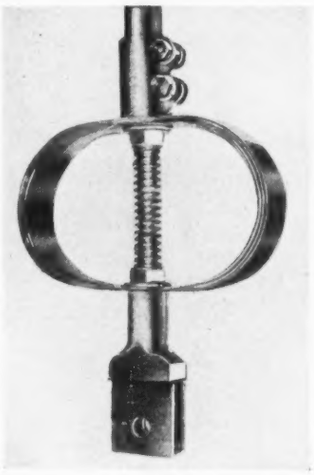
Welder Rated at 600 Amp.

A NEW WELDER WITH A RATING of 600 amp. has recently been announced and placed on the market by the Lincoln Electric Company, Cleveland.

The new welder may be had in either the portable or stationary truck type. It is a motor-driven, single-operator, variable-voltage machine and has a current range of from 180 to 750 amp. The working mechanism of all controls is contained in a ventilated inclosed steel cabinet with hand regulators and switches mounted on a panel which forms a side of the cabinet. The control panel contains rheostat, diverter switch, safety starter switch, volt-ammeter and wing nut terminals for cables and is mounted directly over the motor-generator.

Device Protects Bushings Against Thermal Expansion

A TYPE OF JOINT to protect bushings of oil circuit breakers, transformers, etc., against thermal expansion of their conductors and disalignment due to unequal settling of structure footings is announced by the Delta-Star Electric



Company, Chicago, Ill. When leads are long or the arrangement requires a rigid conductor, it is usually necessary to carry at least part of the conductor weight on the bushing.

The joint carries the weight on a spring, the stiffness of which can be regulated to the amount of load carried. Alignment is maintained by two studs extending part way through the spring and by the current-carrying laminations themselves, which easily deflect along a parallel to the conductor.

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Flush Type Cabinets for Toggle Switches

FLUSH TYPE BRANCH CIRCUIT CABINETS for toggle switches have been announced by the Wadsworth Electric Manufacturing Company, Inc., Covington, Ky. Cabinets are designed to accommodate any standard make of toggle switch. Catalog No. 4 ft. is so designed that toggle switch assembly is below cut-out base, the Catalogs Nos. 6 ft., 8 ft., 10 ft. and 12 ft. have them arranged on both sides of cut-out base. This arrangement makes for a well-proportioned cabinet, simplifies wiring, and effects quite a saving of wire. Toggle switches cannot be attached directly to trim, but to adjustable bridges in cabinet, thus making it possible to remove the trim without disturbing the toggle switch assembly. The rectangular knockouts in trim can easily be removed to install toggle switches, thus permitting any number of switches to be installed up to the number of circuits in the cabinet.